MOSCOW HAS A PLAN

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NOTE

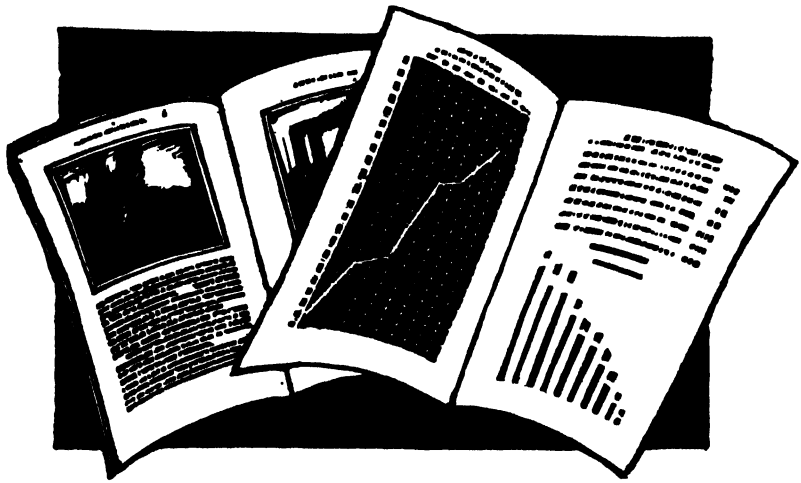
THIS book, designed in Russia for the masses and for young people, is not epoch-making – it is epoch-indicating. It pants with excitement; it laughs with delight as it skips forward through the story of Russia's conscious organization to get the very utmost out of the artificial use of natural forces. When we read it, and find ourselves swept past its naivety, impetuously carried ahead (though all the material is so obvious and familiar), we discover that it is inspired. Then, if we reflect, we may shake our heads sadly and feel chilly at the spine – for we are excited only by mystic contemplation of absolutes; we are bored by applied science – while these folk are inspired by it. We show a symptom of age. They are flamboyant with youth.

How common a thing it is for genius to be childish! There is generally naivety in the expression of something quite new; as if the step forward demands a step backward for stability. *Mieux reculer pour mieux sauter.* The absorption in his discovery blinds the creator to all else.

The style of an original writer seems clumsy; it very likely is clumsy. A school of painting ends in masterly

attention to technique; a school of painting begins by attention to something more essential, and the vehicle of expression is crude. This is just as true of what nations create as of the creations of individual works of art. We, who look on Russia's awakening from the outside, may find it very childish. The modern world's mastery of nature through machinery and applied physics and chemistry has developed in our midst. Is it not a little ridiculous when that great sprawled-out backward country, whose illiterate peasant population increases by some four millions every year, gets excited and even a trifle hysterical about electrification of railways, making buttons from curds, oxy-acetylene welding, and the use of seed-drills in farming? Did they then discover these? Are they not teaching their grandmother to suck eggs?

They are not. Their grandmother grew up to suck naturally, nonchalantly, at the obedience of her whim, or when the particular egg happened to be in season. They have awakened to consciousness of egg-sucking; they would do it efficiently, utilizing it when appropriate as a simple but effective method of obtaining easily assimilable nourishment.



IN THIS BOOK ARE MANY PICTURES

PREFACE

WHAT THE STORY IS ABOUT

1. Figures are Pictures

There are books with stories, with pictures, with poems; books interesting to read and to look at.

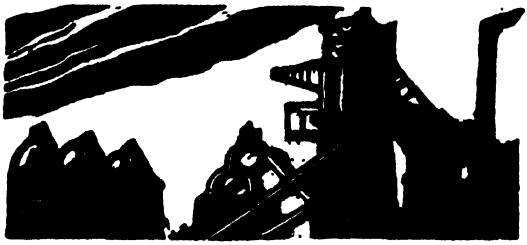
There are also books with figures and tables. From these books we learn much, but we do not read them for pleasure.

But here is a book which consists entirely of figures and tables, and yet it is more interesting than any story of adventure.

In this book every figure is a picture.

Let us take at random a few figures from its pages:

51 378,000 3385 42

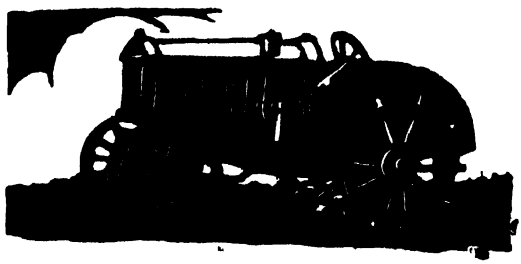


51 means this –

BLAST FURNACES

378,000 means this

TRACTORS



3385 means this –

LOCOMOTIVES

42 means this –

ELECTRIC POWER STATIONS

What do these mean?

At first sight this book contains nothing of interest, just figures such as may be found in any text-book or book of science. But when you begin to read you cannot tear yourself away.

2. What One can see in Figures

On the bank of a large river great cliffs are being broken into bits. Fierce machines resembling prehistoric animals clamber clumsily up the steps of a gigantic ladder hewed out of the mountain.

A river appears where none existed before, a river over sixty miles long.

A swamp is suddenly transformed into a broad lake.

On the steppe where formerly only feather-grass and thistles grew, thousands of acres of wheat wave in the breeze.

Aeroplanes fly above the Siberian swamps, where in little cabins live people with squinting eyes clad in strange dress made of animal skins.

In the Kalmyk region in the middle of the naked steppe grow buildings of steel and concrete alongside the felt tents of the nomads.

Steel masts rise over the whole country: each mast has

four legs and many arms, and each arm grasps metal wires.

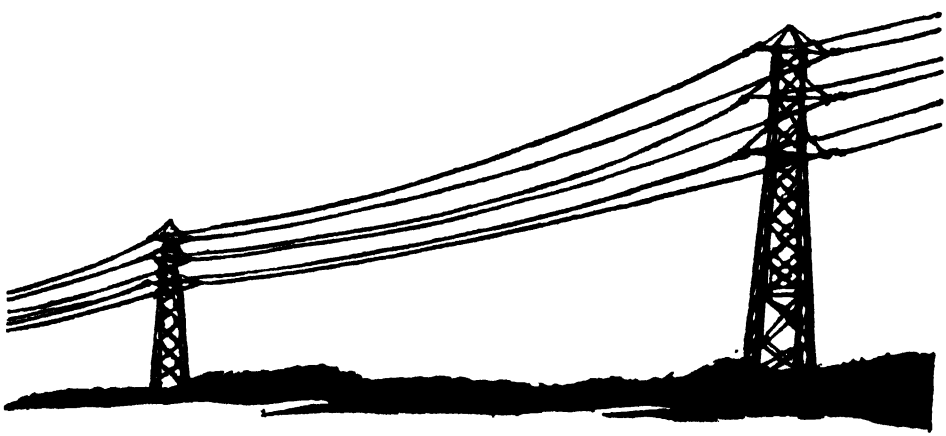
Through these wires runs a current, runs the power and the might of rivers and waterfalls, of peat swamps and coal beds.

All this is in the figures, all this is in the book of figures. And this book is called *The Five Year Plan.*

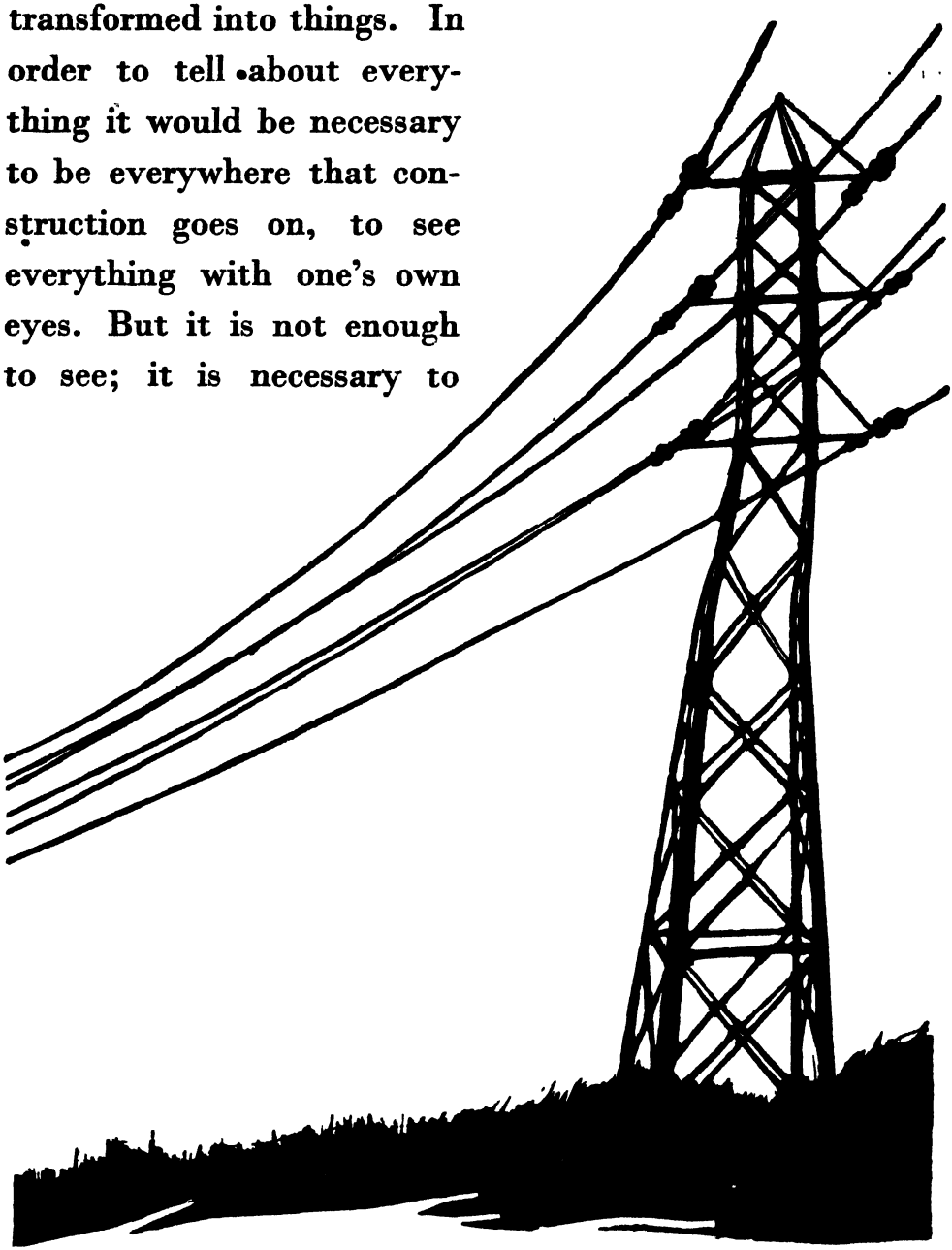
3. A Difficult Task

To tell in one's own words about this great plan is a difficult task. To relate in a small booklet all that is told in 1680 pages of figures, tables, and brief explanations – is this possible? Thousands of people worked over the Five Year Plan and I, alone, wish to tell about everything.

This plan has already ceased to be a plan; figures are already



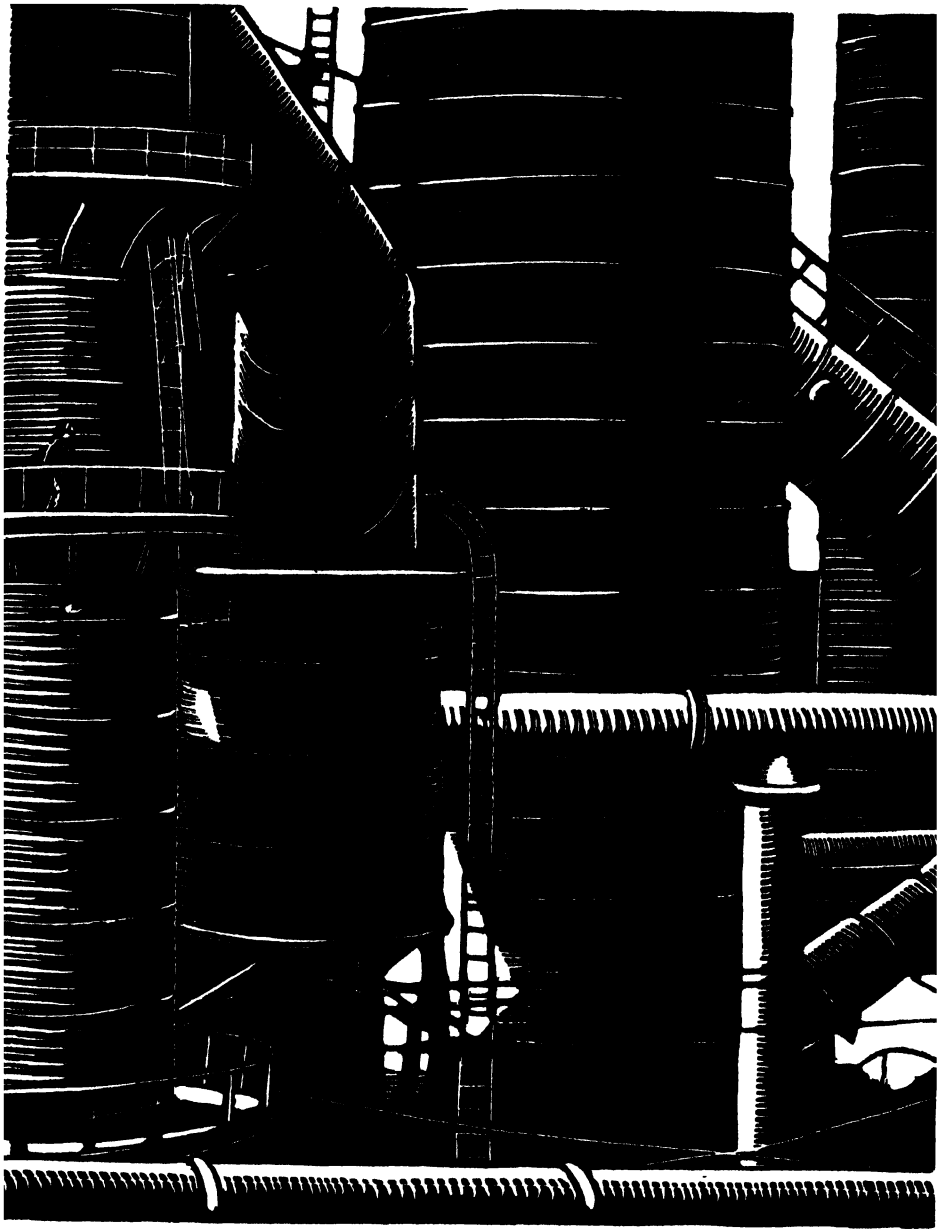
transformed into things. In order to tell about everything it would be necessary to be everywhere that construction goes on, to see everything with one's own eyes. But it is not enough to see; it is necessary to



understand also. I am an engineer: I know best that little corner of technology in which I work. But I have to write about the entire programme of construction. In order to accomplish this task well I should be a metallurgist, an agronomist, a mechanic, a builder, a chemist, an economist, a civil engineer, and a hydro-technologist.

To be everywhere and to know everything is impossible.

Of course there is much about which I shall not speak, there is much that I shall omit. Others will tell more: others will tell you of things I do not mention and will further illuminate those things concerning which I say little.



IN THE DON BASIN AND IN THE URALS THERE RISE TOWARDS THE SKY, ONE AFTER ANOTHER, TOWERS OF STONE AND IRON—GIGANTIC BLAST-FURNACES

MOSCOW HAS A PLAN

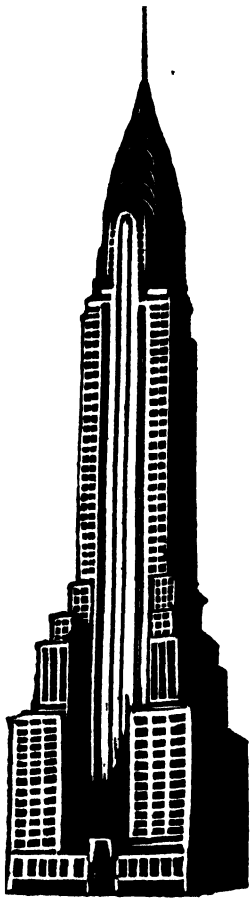
I. TWO COUNTRIES

1. The Project of Our Country

The Five Year Plan is a project: not of one factory but of 2400 factories. And not only of factories, but also of cities, of electric stations, of bridges, of ships, of railways, of mines, of government farms, of collective farms, of schools, of libraries. It is a plan for the reconstruction of our whole country and was prepared not by one man or by two men, but by thousands of trained persons. To the work of building came not tens, but millions of workers. All of us will help to build the Five Year Plan.

The plan was first discussed in December 1927, at the Fifteenth Congress of the Communist Party.

On the 1st of October 1928 its fulfilment was begun. And before the end of 1929 it became clear that the plan will be achieved, not in five years, but much more quickly.



THIS IS ONE OF THE TALLEST BUILDINGS IN AMERICA, BUT THERE IS ONE STILL TALLER. RECENTLY THEY HAVE BUILT THERE A HOUSE 1030 FEET HIGH

Such a project has never been undertaken before. America has many large factories, many more than we have. There, factories turn out four automobiles a minute; there, some buildings are sixty stories high; there, a huge steel bridge was recently constructed in one day; there, a million tractors work in the fields. The Americans are proud of their machines, of their factories.

But how do these factories work? According to some general plan, do you suppose? No, they work without a general plan.

2. What Happens When they Work Without a Plan?

Mr. Fox acquires money – say £100,000. But money must not remain idle. Mr. Fox looks through newspapers, he con-

sults his friends, he employs agents. From morning till night the agents comb the city, look about, and make inquiries. What is to be done with Mr. Fox's money?

Finally a business is found. Hats! That is what one should make. Hats sell; men get rich.

There is nothing to hesitate about. Mr. Fox builds a hat factory.

The same idea occurs at the same time to Mr. Pox, and Mr. Crox, and Mr. Nox. And they all begin to build hat factories simultaneously.

Within half a year there are several new hat factories in the country. Shops are filled to the ceiling with hat-boxes. Store-rooms are bursting with them. Everywhere there are posters, signs, advertisements: HATS, HATS, HATS. A great many more hats are made than are needed – twice as many, three times as many. And the factories continue to work at full speed.

And here something happens that neither Mr. Fox, nor Mr. Pox, nor Mr. Nox, nor Mr. Crox anticipated. The public stops buying hats. Mr. Nox takes sixpence off his price, Mr. Crox takes a shilling off; Mr. Fox sells hats at a loss in order to get rid of them.

But business grows worse and worse.

In all of the papers advertisements appear:

YOU MAY HAVE ONLY ONE HEAD, BUT THAT DOES NOT MEAN AT ALL THAT YOU SHOULD WEAR ONLY ONE HAT. EVERY AMERICAN SHOULD HAVE THREE HATS

BUY FOX'S HATS

Mr. Pox offers to sell hats on a three-year instalment plan. Mr. Nox announces a sale:

ONLY FOR ONE DAY! TAKE ADVANTAGE OF THIS OPPORTUNITY!

But this does not help. Mr. Fox lowers the wages of his workers four shillings a week. Mr. Crox lowers the wages eight shillings a week. Again business grows worse and worse.

All at once – *stop!* Mr. Fox closes his factory. Two thousand workers are discharged and permitted to go

wherever they please. The following day the factory of Mr. Nox stops. In a week practically all hat factories are standing idle. Thousands of workers are without work. New machines grow rusty. Buildings are sold for wreckage.

A year or two pass. The hats bought from Nox, Fox, Pox, and Crox wear out. The public once more begins to buy hats. Hat stores become empty. From the top shelves dusty cartons are taken down. There are not enough hats. Prices of hats go up.

And now, not Mr. Fox, but a certain Mr. Doodle thinks of a profitable business – the building of a hat factory. The same idea also enters the heads of other wise and business-like people – Mr. Boodle, Mr. Foodle, and Mr. Noodle. And the old story begins over again.

The experience with hats is repeated with shoes, with sugar, with iron, with coal, with paraffin. Factories are blown up like soap-bubbles and burst. One would think that people had lost their minds.

3. A Mad Country

On the 1st of September 1920 a train left Washington: an engine and thirty trucks. The trucks were loaded to the top with water-melons. The melons were ripe and sound and

every one cost a shilling. The train went rapidly northward.

On the bank of the Potomac River, where the track passes along a cliff, the train stopped. Workers bustled about near one of the trucks.

And all at once splash, splash! One melon fell into the water, a second, a third. A whole stream of melons rushed over the cliff into the river below. They jumped like croquet balls, collided, and broke into bits. Near the shore in the water a raft of melons was formed – a green floating island. And the melons continued to come. The first truck was followed by a second, the second by a third. The work went on efficiently: a truck in two minutes: thirty trucks in an hour.

The engine blew the whistle, the people jumped aboard, and the train disappeared. Slowly the water-melons floated with the current down the Potomac River.

I did not invent this story. If you do not believe it, get a book called *The Tragedy of Waste*, written by Stuart Chase. He is an American and a member of the staff of the Labour Bureau in New York City. You will find the tale about the water-melons on page 102.

This book tells us many other interesting things:

"In the year 1920 thousands of gallons of milk were spilled into the rivers and creeks of Southern Illinois."

"In October 1921 placards were placed along the highways

in the middle-western states advising the farmers to burn corn instead of coal."

On 24th June 1924 the *New York World* announced: "Thousands of packages of cucumbers were destroyed on the offal dock to-day."

"Every few years a large percentage of the Maine potato crop is left to rot in the ground."

And here is a recent dispatch from the American newspapers: "In the western states again, as in 1921, grain is being burned in place of fuel."

On the cotton plantations they breed a weevil which destroys the cotton crop.

Motor-car manufacturers spend thousands of pounds for the purchase and destruction of used cars. Steamship companies wreck hundreds of the latest steamships and motor boats.

What does this mean? Have people lost their senses, or what is the matter? The burning of corn, the spilling of milk, the destruction of motor cars, the wrecking of steamships – why is this done? Who profits by it?

It is profitable to the Foxes and the Poxes. Mr. Fox burns a few trainloads of grain in order to raise the price of corn. Mr. Pox gives orders to spill tens of thousands of bottles of milk into the river in order that milk may not be sold too cheaply. And in the meantime school physicians in

New York report that one out of every four children in the city is under nourished.

In a country boasting millions of machines, store-rooms are bursting with goods, corn is burned in place of coal, milk is poured into the river. And at the very same time in this very same country thousands of people go hungry.

ONE OUT OF EVERY FOUR CHILDREN IN NEW YORK IS UNDER NOURISHED

Americans say with pride: "Every American worker has two hundred and thirty mechanical slaves." If we count the number of machines in the country and the number of workers they replace, then this statement is true.

Why then, if this is so, are millions of American citizens in need of the most essential things?

What is the matter here?

The matter is that all these mechanical slaves, all these

magnificent machines, belong not to all Americans, but only to a very few. Just one "automobile king," Ford, owns sixty automobile factories in America, and twenty-eight factories in other countries. He has his own railway, his own steamships, his own mines, his own forests, his own mountains, his own rivers. If all of the workers in his factories with their families were brought together and put in one place, they would make a city with a population of three million persons. This is as if all Moscow and half of Leningrad in addition worked for one man.

Because a single man owns the machines, millions must work for him.

4. The U.S.S.R. and the U.S.A.

Every American worker has two hundred and thirty mechanical helpers: each Soviet worker has only twenty.

But among us, the mechanical helpers belong not to Mr. Fox and not to Mr. Pox, but to the workers. And this at once changes the whole situation. Workers do not wish to break up motor cars: they do not wish to pour milk into the river, to burn corn in place of coal, to destroy sacks of cucumbers. Workers understand that motor cars, milk, corn, and cucumbers represent labour. They know that if

there is to be a car someone must make it. Why then should labour and time be expended in vain?

We have a plan.
In America they work without a plan.
We have a seeding campaign.
In America they destroy crops.
We increase production.
In America they reduce production and increase unemployment.
We make what is essential.
In America hundreds of factories consume raw materials and energy in order to make what is altogether unnecessary.

Stuart Chase says: "We drown in a sea of things which we do not use, which we lose, which get out of style, which we give to friends and which they do not need, which disappear somewhere; fountain-pens, cigar-lighters, cheap rings, razors, endless trinkets, gew-gaws. We destroy mountains of good iron ore and an endless quantity of horse-power in order in a few months to fill rubbish cans with them."

And how much money is spent on advertisement!

To read all of the advertisements which appear on one day in the American newspapers would require five hundred

years. In picturesque places along the highways great coloured placards are set up. At the edge of a beautiful forest you are urged to buy *Smith's Tooth Paste*; on the crest of a famous mountain you are greeted by a sign extolling the virtues of *Kickapoo Indian Sagwa*. In the evening, cities are flooded with the light of innumerable electric signs and inscriptions. The roof of the Cleveland Company in a certain American city carries the advertisement: "This sign burns more electricity than a whole city."

Millions of tons of raw materials and fuel, millions of working days are consumed in order to force people to buy what they do not need. Human labour is dissipated and expended for nothing.

And this happens because the mechanical slaves are the property of Mr. Fox and Mr. Pox, and not of the workers. What they make, so long as they make money, is a matter of complete indifference to these gentlemen.

For what purpose does Mr. Fox build a hat factory? Is it really in order to make hats? Not at all, but rather to make money. To him every factory is a money factory, a profits factory.

And for Mr. Fox and Mr. Pox a worker is not a worker, not a man, but a machine for making profits. They take good care of an ordinary machine made of iron and steel and do not overload it with work, because it costs too

much money. But since a human machine in an American factory costs nothing, it is always overloaded with work. If it wears out or loses its strength – away with it. Others can be had.

Stuart Chase says that after his fortieth birthday a worker is no longer wanted in a factory. At that age the American worker is an old man.

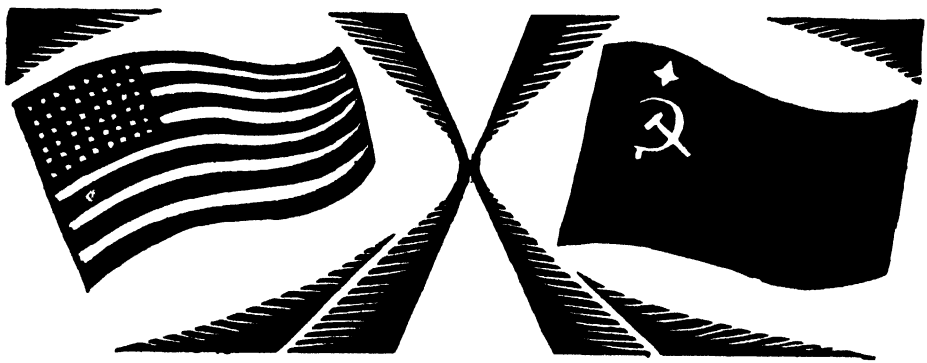
In America the machine is not a helper to the worker, not a friend, but an enemy. Every new machine, every new invention, throws thousands of workers out upon the streets. In glass factories one person now makes three thousand bottles an hour. In former times such a task required seventy-seven men. This means that each machine for the making of bottles deprives seventy-six men of employment. And the American worker despises the machine which takes away his bread.

A certain American writer says: "Machines breed and multiply: there are more and more of them. We ourselves have nurtured them, but now they surround us like wild and dangerous beasts. And we are in their power."

But how is it with us? The more machines we have the easier will be the work, the shorter will be the working day, the lighter and happier will be the lives of all.

We build factories in order that there may be no poverty, no filth, no sickness, no unemployment, no exhausting

labour – in order that life may be rational and just. We build factories in order that we may have as many mechanical helpers as possible – machines in order that these mechanical helpers may belong to all and work for all equally. We build in our country a new unheard-of order, a socialistic order.



II. THE SCOUTS OF THE FIVE YEAR PLAN

1. The Scouts of the Five Year Plan

It is easy to say, "We will build hundreds of new cities, thousands of new factories." But out of what are we to construct them? Certainly not out of air. Have we enough brick, cement, and glass for construction? Have we enough iron for machines?

Of finished goods we have little, but of raw materials we have as much as you wish.

If from a car window you see only waste land, forests, and swamps, you see nothing.

Waste lands are clay, sand, and stone.

Forests are beams, rafters, staves, and ties.

Peat swamps are electric current.

Out of clay and sand we make bricks; out of sand and lime – cement; out of iron ore – steel.

We must find raw materials. Our first task, therefore, is exploration. One should never begin a battle before the work of scouting has been done.

Every year we send expeditions to the most distant

IF YOU BECOME FRIGHTENED, YOU WILL FALL INTO A CREVASSE AND EVEN YOUR BONES WILL NEVER BE SEEN AGAIN

regions – beyond the polar circle, to the deserts of Kazakstan, into the mountains of Altai and Pamir.

One troop of scouts makes its way over the marshy tundra of Siberia. It goes without maps, almost by guess-work. Its members wear black masks of netting. Otherwise they would be devoured by mosquitoes and gnats. As the troop proceeds, it is closely followed by a pursuing swarm of these vicious insects. The tundra is like a flat plate, without a single hill, without even a solitary shrub.

At the same time, far to the south goes another troop of scouts. It proceeds up a mountain ridge as up the cornice of a giant house. Below are hundreds of feet of empty space. If you become frightened, you will fall into a crevasse and even your bones will never be seen again. But the scout must not know fear. So he moves on, leaning with his entire body against the stony wall and cautiously feeling his way around projections with his feet.

During the ten years following 1919 the Academy of Science alone organized three hundred and seventy-one expeditions! And how many scouts did not our other scientific institutions send out! How many persons have been commissioned to explore these places where we have decided to build railways, to dig canals, to put down coal mines, to construct factories!

Throughout the entire country our scouts are at work.

2. What the Scouts Say

What then do the scouts say? Have they succeeded in discovering anything?

They tell us that we are still altogether ignorant about our country. They say that as yet our country has not even been discovered.

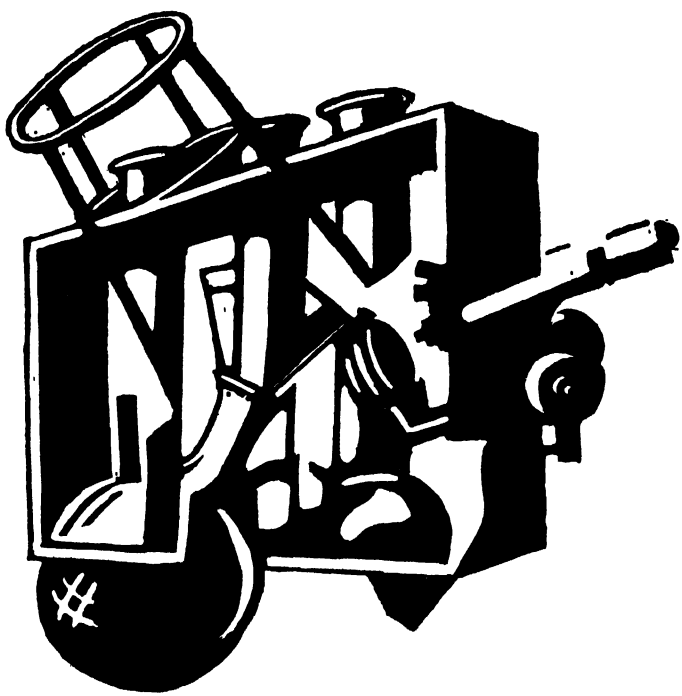
Beyond the polar circle in the middle of the tundra of Karelia they have found the huge Hibinsky Mountains. And do you know what these mountains are made of? They are made of the most valuable raw materials – nephelite and apatite. Nephelite will give us glass. Apatite will give us phosphates – fertilizers for our fields. And of these raw materials there are tens, no, hundreds of millions of tons.

In the desert of Kara-Kum our scouts stumbled upon strange hills. These hills suggested that giants had amused themselves making little bricks out of sand. But on examination the little bricks were found to be not sand, but a mixture of sand and sulphur. And sulphur we buy from Italy. We bring it from afar, and we pay large sums of money for it. We use sulphur in making paper and resin. Also, with sulphur we can spray grain and cotton and protect them from insects. We have suddenly found that we have as much sulphur as we want.

In Siberia scouts found lakes containing rich deposits of

soda. But do you know what soda is? Without it you cannot make soap. And not only soap, but also many other things. Soda is usually made of salt. For this, large factories are built. And there it lies in the lake ready-made. just to be taken!

In Yakut scouts discovered great cliffs – higher than a six-story building – made of the purest rock-salt. But we have salt in other places. They found in Yakut a yet more remarkable thing – huge transparent crystals of gypsum, about fourteen inches square. A regular window-pane, only not made of glass, all ready to be placed in the window.



And the khandrila in Kazakstan! Khandrila is a kind of plant. In its stems our scientists noticed a certain strange liquid. They tested it and found it to be raw rubber. And we import raw rubber for our rubber factories from abroad.

And it is not possible to enumerate all that the scouts have found!

But the scouts work not only in forests, steppes, and waste-lands. They work in every laboratory. It is not necessary for everybody to travel a thousand miles, to get drenched by rain, to have teeth chatter from extreme cold. Here at this table, in these glass tubes, we will make valuable discoveries for our industries. We will teach factories how to get raw materials from wastes, from what is not needed, from what is everywhere, from what lies under our very feet. Already we know how to make paper and cardboard out of reeds, fine cloth out of ordinary coarse wool, sugar out of the waste of sugar factories.

We have plenty of raw materials. About this we need not worry. Our country only *seems* poor and empty. We shall build electric power stations in the peat swamps and send the power of peat over wires as electric current. From fir trees we will make paper. We will plough and seed the steppes covered with feather-grass and thistles, and they will give us bread.

In time also we will force the wind to work for us.

Our scientists have invented new and practicable wind motors.

And under the earth we have coal, iron, zinc, copper. We have only begun to discover our riches.

Five years ago we thought that we had in the Kuznetz Basin of Siberia only two hundred and fifty billion tons of coal. And now the scouts have found there one hundred and fifty billion tons more. What a find! This would make a mountain of coal over three miles high. How did it happen that they did not see such a huge mountain before?

Because coal does not lie on the surface of the ground, because it is not piled in a heap. It lies in layers deep down in the earth. From the surface one cannot see whether there is any coal under the ground or not. In order that we may get to it, a shaft must be sunk into the earth. But this is not so simple. To dig down into soft earth is easy; but suppose we encounter layers of hard stone? Then no tool of steel will serve, only a diamond drill will do the work.

But why talk of the Kuznetz Basin! There we have just begun to construct mines, while in the Don Basin work has been going on for half a century. Well, then, do we know the Don Basin?

No, we do not even know it. There we must sink shafts almost at a guess, not knowing, as we should, what kind of a layer we shall find, how far it goes, and how thick it is.

And iron!

Did we really know a few years ago that there is iron in the Lower Volga Region? And now we have already begun the construction there of a large smelting works which will give us six hundred and fifty thousand tons of pig-iron a year.

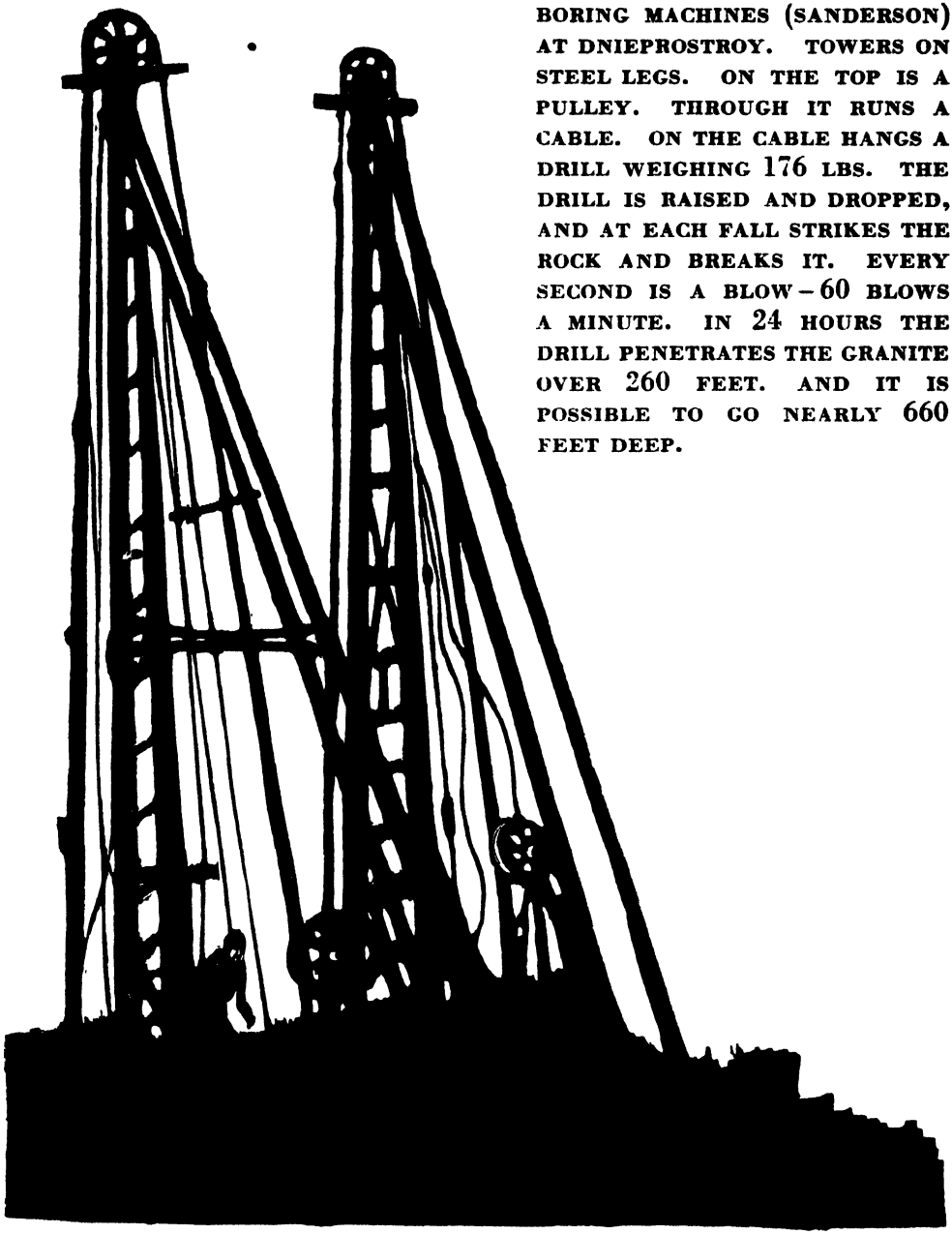
It is the same with oil. Recently Professor Preobrazhensky discovered oil where formerly no one ever thought of looking for it – within twenty-five miles of Perm. And scientists say that there must be oil all the way from the Middle Volga to the Urals.

In a word, everywhere we must prick into the earth core with a "little pin" – a scouting drill. So exploration goes on. In many places there stand already long-legged steel giants – towers equipped with drills. They drive steel and diamond drills into the ground through the rock, and to the riches hidden under tens and hundreds of yards of "empty," unprofitable earth.

3. Every School-child must be a Scout

Every school-child dreams about a journey to distant lands – to Africa, to America, to India.

But why go so far? Do you know the locality in which



BORING MACHINES (SANDERSON) AT DNIEPROSTROY. TOWERS ON STEEL LEGS. ON THE TOP IS A PULLEY. THROUGH IT RUNS A CABLE. ON THE CABLE HANGS A DRILL WEIGHING 176 LBS. THE DRILL IS RAISED AND DROPPED, AND AT EACH FALL STRIKES THE ROCK AND BREAKS IT. EVERY SECOND IS A BLOW – 60 BLOWS A MINUTE. IN 24 HOURS THE DRILL PENETRATES THE GRANITE OVER 260 FEET. AND IT IS POSSIBLE TO GO NEARLY 660 FEET DEEP.

you live? Can you tell whether it contains peat swamps, timber, lime, phosphate, brick and pottery clay, building-sand?

You, of course, do not know these things.

And the first journey which you should undertake is a journey through the region surrounding your city or village.

Organize expeditions, prepare detailed maps. On these maps indicate everything that could be used in the Five Year Plan. Ask older comrades and teachers to help you; learn from them how to recognize minerals. As yet you do not know how to use your eyes. You can hardly distinguish a piece of ore from a common stone. And a scout should know this.

Books alone are not enough here. You must see and touch for yourself. Remember that the country in which you live has not yet been discovered.

Discover it!

III. CONQUERORS OF THEIR OWN COUNTRY

1. Conquerors of their own Country

Following the troops of scouts goes an army of conquerors, an army of workers.

What are they going to conquer?

They go to conquer their own country.

But really must it be conquered? Is not the land in which we live our own?

No, it is not ours. Ask informed people and they will tell you that we still have a great deal of unowned land, unowned forest and unowned steppe. But what does "unowned" mean? It means not our own.

And in truth can we really call unpeopled steppes our own? Can we really call Yakutia our own? Yakutia is a vast region; it is a fifth part of our entire Union. And how many people live there? Two hundred and eighty thousand. In all of Yakutia there are only as many inhabitants as in a few streets of Leningrad or Moscow! In Yakutia are limitless forests. Every summer, fires destroy there thousands of acres of woods.

SNOW, ICE AND FROST IN THE NORTH

In Yakutia there is also coal, and iron, and silver, and lead, and gold.

But the coal which lies untouched beneath the soil is as yet nobody's coal. And the forest which we do not cut and which we do not protect is as yet nobody's forest. All of this will be ours, if we will it so, but as yet it belongs to no one.

Our steppes will truly become ours only when we come and with columns of tractors and ploughs break the thousand-year-old virgin soil. Then these steppes will be ours. But until then they will belong to no one.

We must discover and conquer the country in which we live. It is a tremendous country. Over 5600 miles from

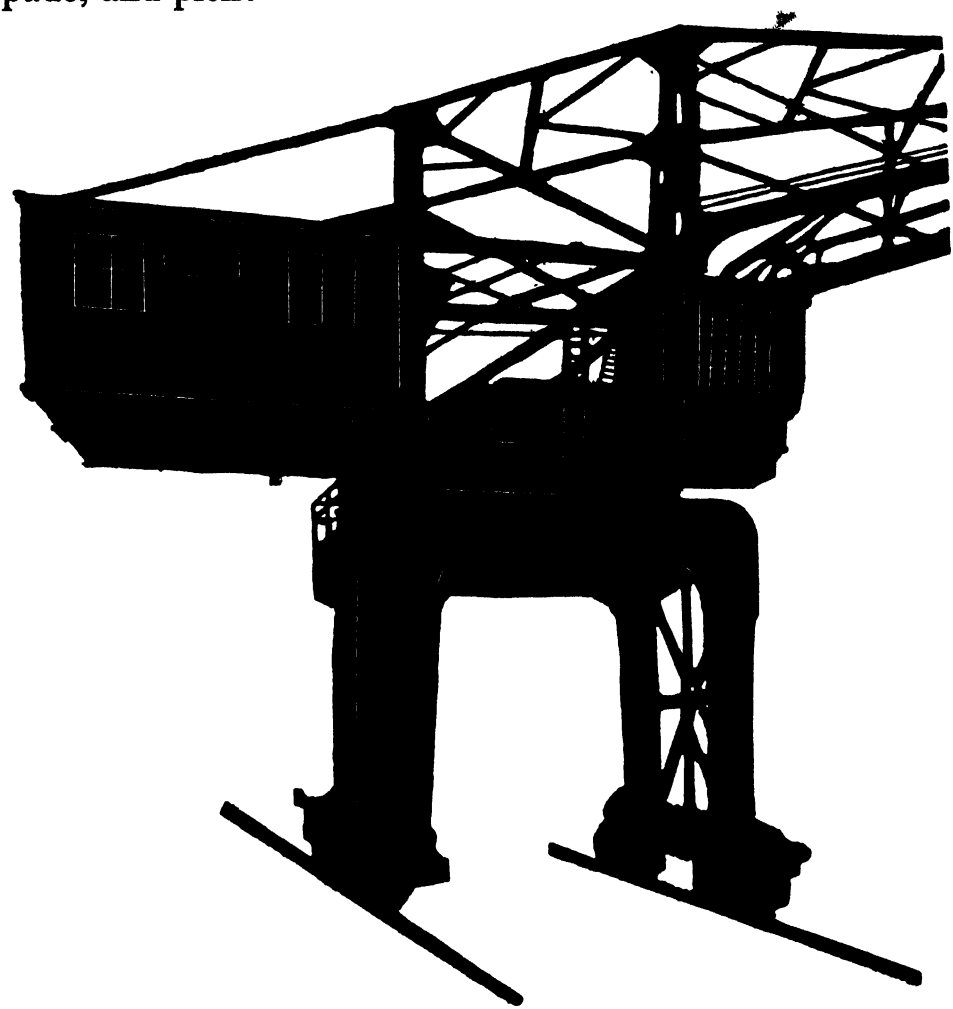
west to east, 2800 miles from north to south. The world's coldest region is in Verkhoyansk – there it is sometimes forty-five degrees below zero! And in Samarkand the heat is tropical – there in the summer it is as hot as in Africa near the sources of the Nile. Snow and ice in the north – palms in the south.

On such a far-flung front have we to wage war.

And the Five Year Plan is one of the first great battles in the war. We must dig into the earth, break rocks, dig mines construct houses. We must take from the earth, lift, and transport millions of tons of ore, of coal, of peat, of building materials.

PALMS AND TROPICAL HEAT IN THE SOUTH

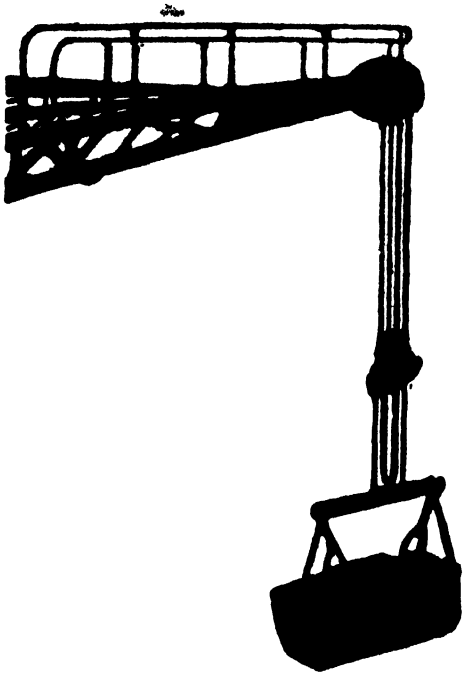
But are we to do all of this with our hands? With shovel, spade, and pick?



A CRANE. IT MOVES ALONG ON RAILS. IN THE LITTLE CABIN IS THE MECHANIC WHO DIRECTS THE CRANE. A BUCKET IS ATTACHED TO THE CABLE. IT CAN OPEN AND SHUT. THE CRANE USES IT AS A PAW – IT GRABS A HANDFUL OF COAL, PRESSES IT INTO ITS FIST AND CARRIES IT WHEREVER NECESSARY. IF THEY LOAD LARGE THINGS LIKE MACHINES AND CASES, IN PLACE OF THE BUCKET THEY ATTACH A HOOK TO THE CABLE.

No, other weapons are needed here.

We must have a shovel which can raise a waggon-load of earth at once. We must have a pick which can break huge boulders into bits.



But even if we should make such a shovel or such a pick, who would wield it? Obviously giant workers are needed.

But are there such giant workers?

There are.

2. Giant Workmen

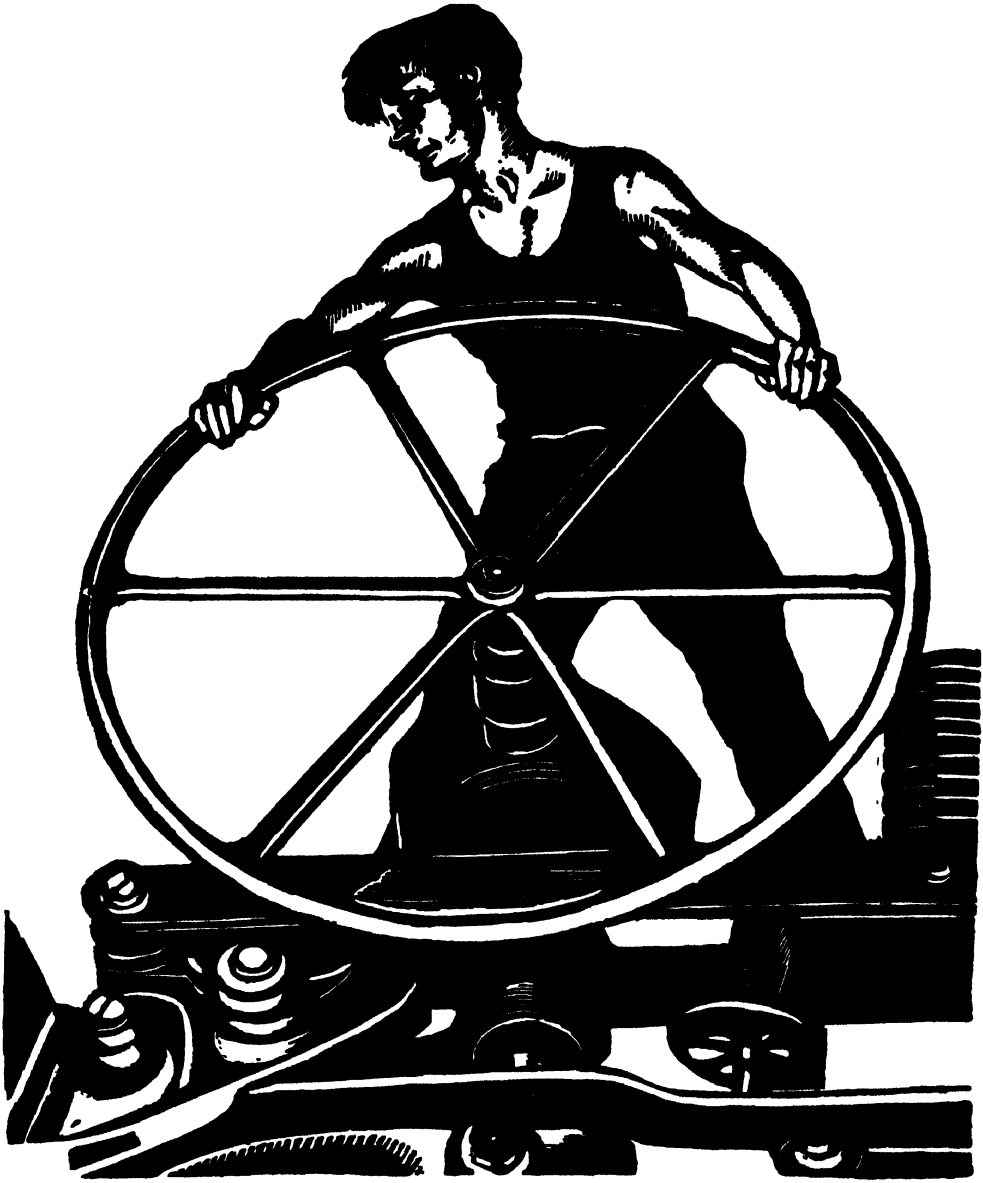
There is a giant excavator. It has only one arm, but this arm is sixty-five feet in length. In its hand it holds a shovel. This is not really a shovel but a huge scoop or bucket with a long handle. In the little cabin at the base of the arm sits one man, a mechanic, with seven electric motors. For each movement of the excavator there is a special motor like a special muscle.

The mechanic first turns on one motor. The scoop cuts into the ground with teeth made of forged steel, and is filled with earth.

Then he starts another motor. The handle slowly moves upward, raising a great bucket of earth. Stop! The third motor begins its work. The giant excavator turns to the left in a circle, as a soldier at drill. And there a truck is already prepared to receive its burden. The operator pulls a chain, the bottom of the bucket opens, and the earth rushes like a waterfall into the iron box of the truck.

There is another giant loader which resembles its comrade the excavator. It also has a huge arm. But in this arm it holds not a shovel, but a cable with a hook at the end. If a load is to be raised, this giant grabs the load with the hook and drags it wherever is necessary.

Then there is a tall mast which acts as a giant stone-mason. If, let us suppose, the foundation for a bridge or dam is to be laid, wooden forms are first built and then into these forms liquid cement is poured. And it is here that we make use of the giant stone-mason. At the bottom of the mast liquid cement is poured into a container. A mechanic starts the engine, and the container flies upward along the mast. Stop! It reaches the top and empties the cement into a trough. And along the trough the cement, like a stream,

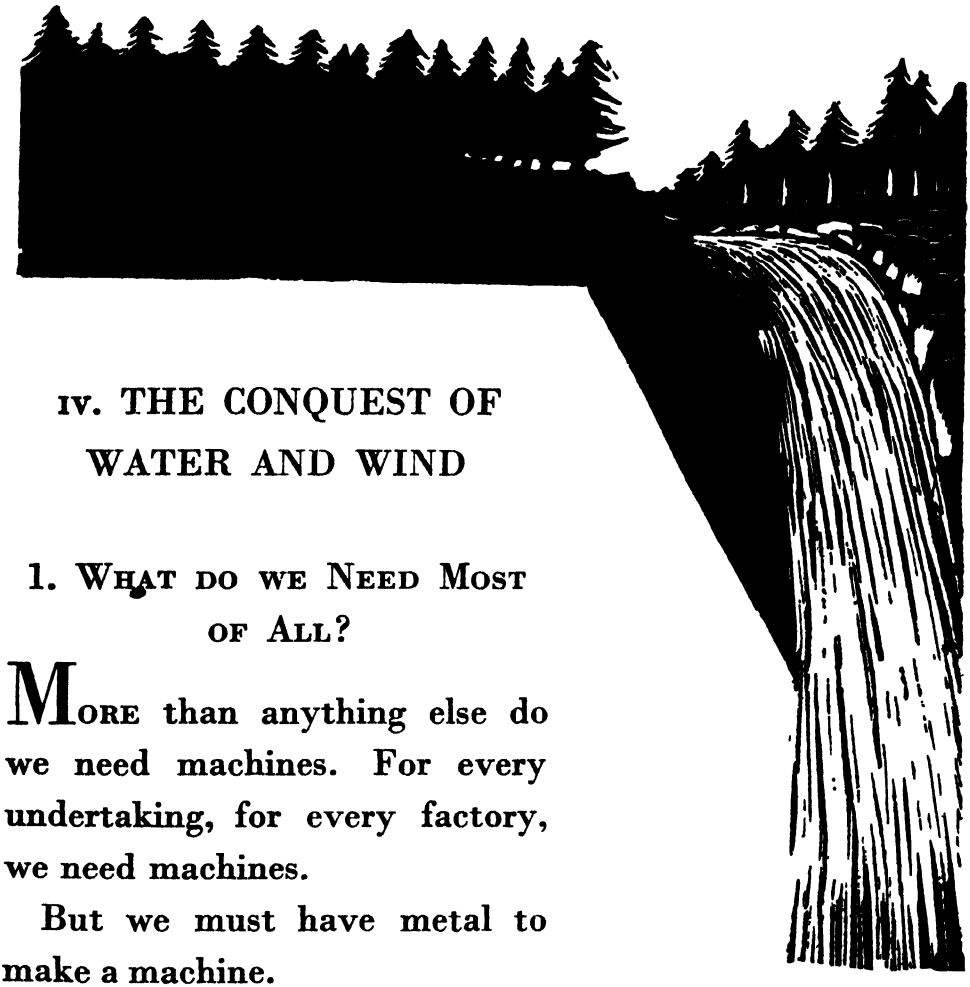


MECHANIC STARTING THE MACHINERY OF THE BALKHNA PAPER MILL

runs directly into the form. A stream of liquid stone! And where? In the air high above our heads!

Men have invented many giant machines. There are machines that burrow into the earth; there are machines that gnaw through a bed of coal; there are machines that suck slime and sand from the bottom of a river. One machine stretches itself upward in order to raise loads aloft; another squeezes itself flat so as to be able to creep and crawl under the ground.

One machine has teeth, another a trunk, a third a fist. The first gnaws, the second sucks, the third strikes. And each one has its own name. The earth-digger is called an *excavator*, the loader – *a crane*, the stone-mason – a *cement mixer*, the borer – a *drill*, the coal-digger – a *hydraulic hewer*. Innumerable machines have been invented and we shall need them all in our great work.



IV. THE CONQUEST OF WATER AND WIND

1. What do we Need Most of All?

More than anything else do we need machines. For every undertaking, for every factory, we need machines.

But we must have metal to make a machine.

And to make a machine go we must have energy.

Now what is energy and whence does it come?

It is all around us in abundance. The force of the wind is energy. The waterfall is energy. A piece of coal is energy. A log which we put on the fire is energy.

Wind, water, coal, wood may not be alive, but they can

be made to work. They can be compelled to turn the wheels of machines. In Baku the wind turns the wings of a windmill, and the windmill pumps oil from beneath the earth.

In Volkhovstroy water turns the wheels of water engines – turbines, and the turbines drive machines which produce electric current.

In every locomotive, coal causes water to boil and transforms it into steam, and the steam drives the piston of the engine.

This means that our first task is to get energy for our machines.

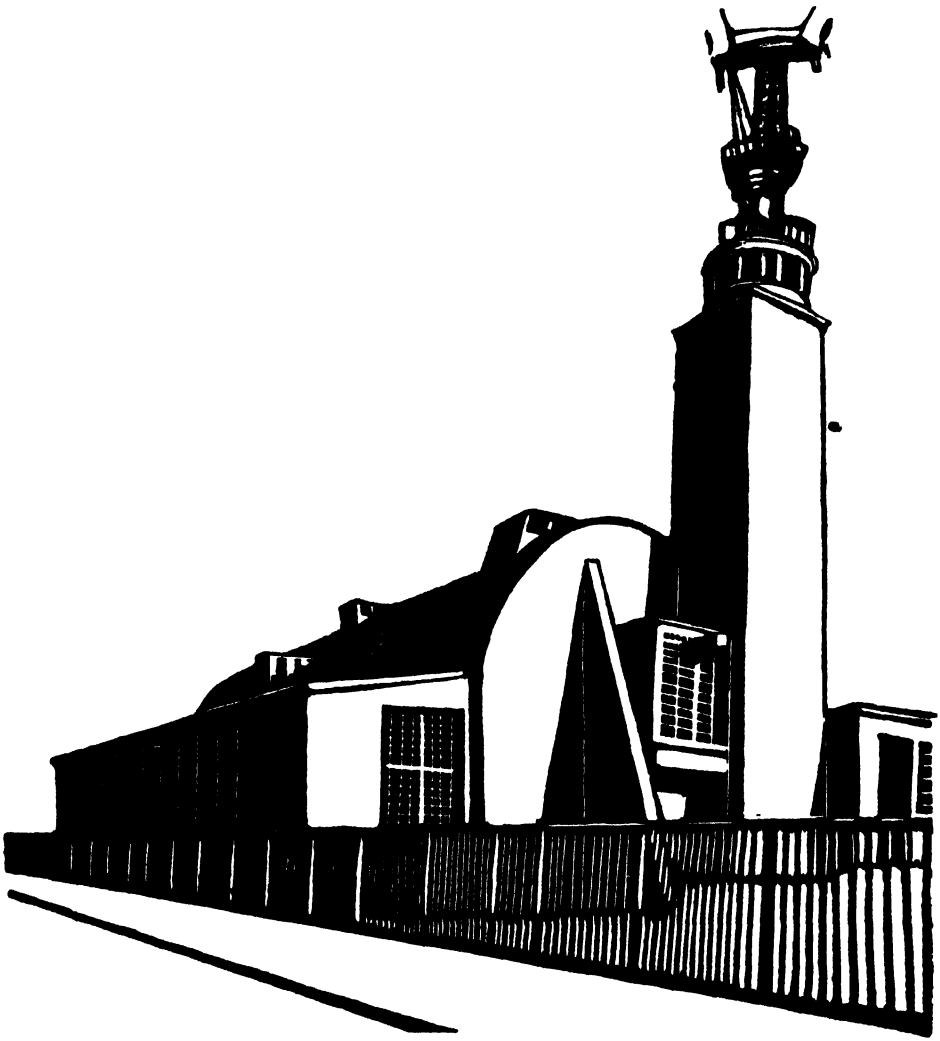
3. What Can the Wind Give us?

In Moscow on Voznesensky Street may be seen a peculiar building. It would not seem so queer except for a tall tower adjoining the building on the right side. This tower is square and almost windowless. On it stands another tower made of glass with a steel frame. And on the very top of the second tower, like a weather-cock, turns a strange contraption resembling a flying-machine of unusual design. This is a department of the Central Aero-Hydraulic Institute where wind-motors are invented. And what you see turning

on the top of the second tower is a new windmill being tested by the Institute.

If we were to build such windmills throughout the country, we would capture more energy than the whole world requires to-day. In time, of course, the need will greatly increase. Then, wherever strong winds blow, windmills will be established. The entire country will be covered with a net of electrical wires. And all wind electric stations, as well as others, will work in this net. Windmills will be placed in regular order like figures on a chess-board. They must be placed so that one tower will not interfere with another. For wind, even as light, may cast its shadows. And if one windmill falls into the wind shadow of another, it cannot

work. Special stations will be constructed to collect and conserve the energy of the wind in order that it may be used during calm weather.



THE DEPARTMENT OF WIND-MOTORS OF THE CENTRAL AERO-HYDRAULIC INSTITUTE. ON THE TOWER IS A WIND-MOTOR

But all of this is a task for future Five Year Plans. The present plan sets the following task: to replace in the village the old inefficient windmills by the windmills of the Central Aero-Hydraulic Institute. And during these five years to raise the strength of all of our wind-motors to five hundred thousand horse-power.

WINDMILLS IN THE OIL FIELDS IN BAKU. THEY DRIVE PUMPS WHICH SUCK OIL OUT OF THE HOLES

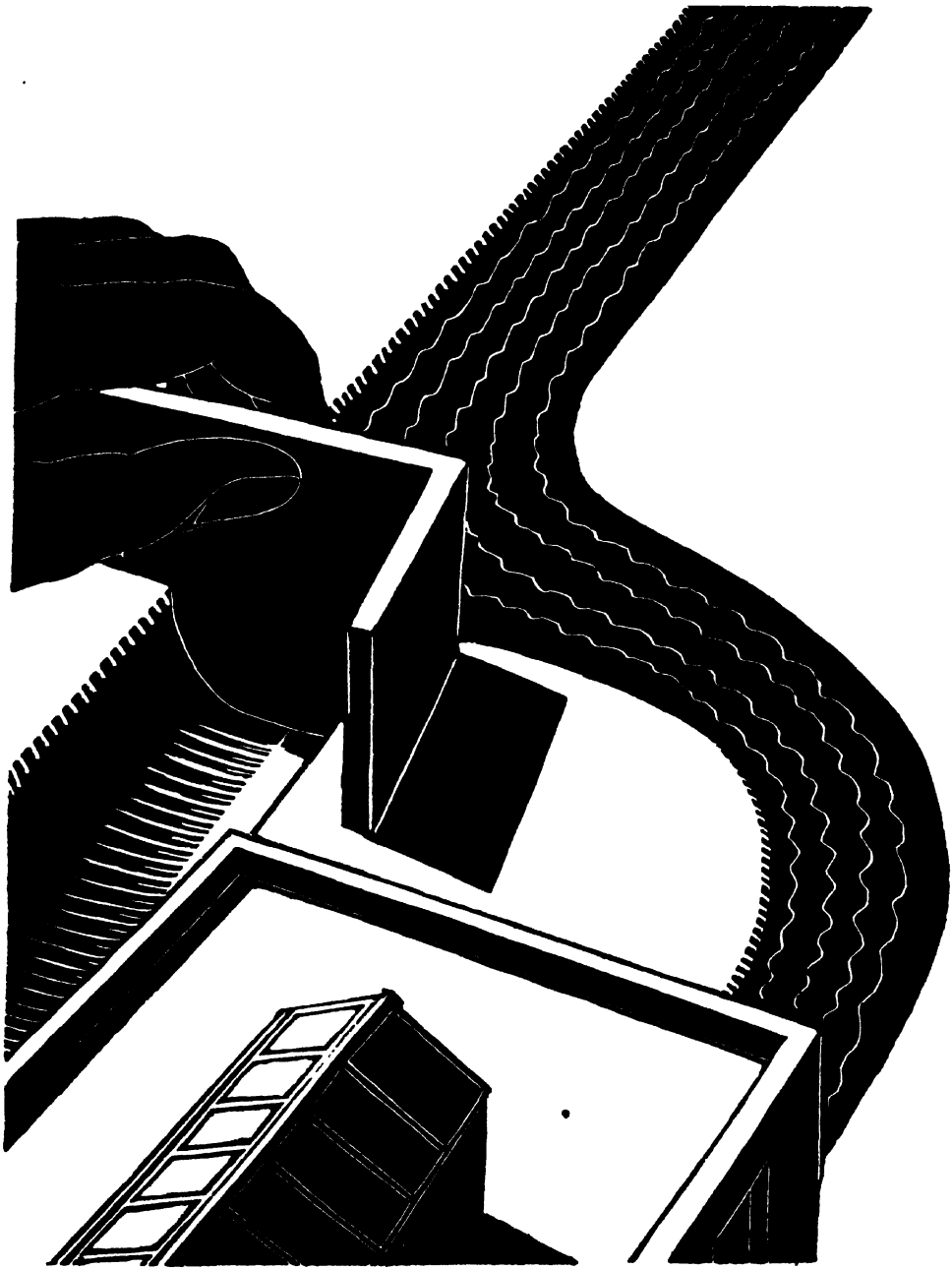
3. The War with the River

To conquer the wind is a difficult task. To force water to work is yet more difficult. Our mountains and plains are well supplied with rivers.

These rivers could give us sixty-five million horse-power of electric energy. But to compel them to work for us is not so easy. Man must fight the river, as the animal-tamer fights wild beasts. If he becomes careless only for a moment, he may make a mistake; and the beast will spring upon him and tear him to pieces. We all read and hear that on the Dnieper is being constructed a great electric power station. There is not a person in the Soviet Union who has not heard of Dnieprostroy.

But few know what a terrific and cruel struggle men wage there with the river.

It would seem to be a simple matter: to build a dam across the river, to install the appropriate water turbines, and to allow the water to turn the wheels of these turbines. But this is easy to say and very difficult to do. For the dam being built on the Dnieper will be a stone wall over half a mile long and as high as a many-storied building. To construct such a wall on land would not be easy. This one must be built across a great river! And the



river refuses to stand still, it refuses to be quiet while it is harnessed.

4. River, Stand Back!

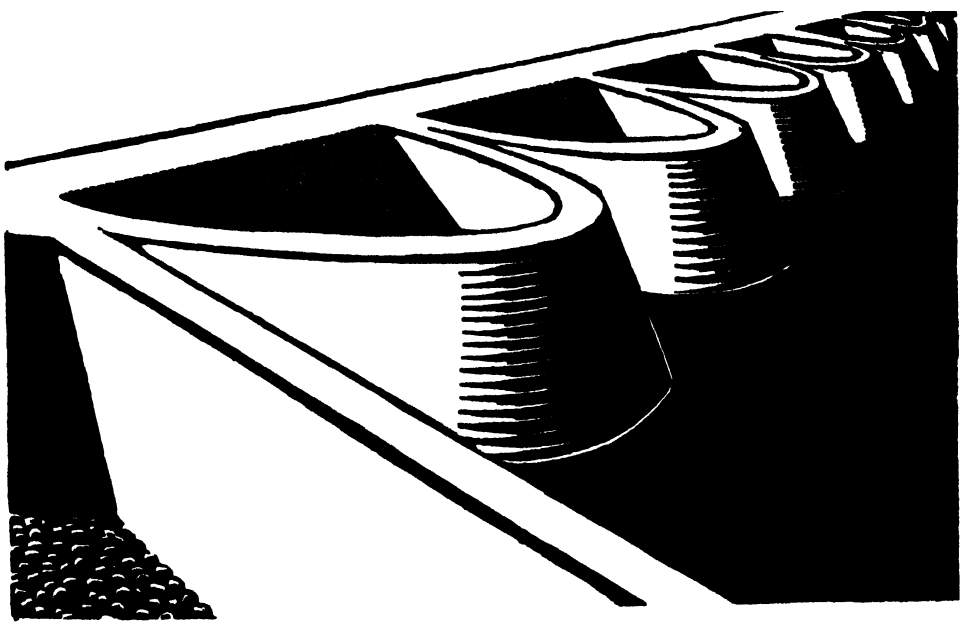
Look at the picture on page 63. The work on the river is being carried out on dry ground – on the naked bottom of the river. How then did the workers force the Dnieper to stand back? For only in a fairy story does this happen: River, stand back!

This is how they did it: they first fenced off a part of the river with temporary wooden dikes, and then with powerful pumps they removed the water from the enclosure. The bottom being laid bare they could work on the bed of the river as on land! But the river is furious. The dike is like a bone in its throat. It is determined to wash out this obstruction, to dash into the artificial basin, to drown both people and machines! And on one occasion the river did succeed in breaking through. On the 24th of June 1928, it suddenly demolished the lower dike. The water rushed into the enclosure, and in about an hour the great basin was filled with water. The workmen had barely time to save themselves and their machines. Divers were lowered to discover what was the matter. They found that the river had washed a great hole thirty-three feet square under the dike. With

difficulty they filled this hole with sacks of straw and rubbish. Then they began to pump out the water. And this task required twenty-seven days. Twenty-seven days to repair what the water had done in one hour!

5. How the River Smashed a Steel Wall

But a yet greater misfortune occurred on the 12th of July. Work was proceeding on the dike of the right basin: a wall of steel rails was being erected next to the wooden dike. Two large cranes were at work. They worked with the speed and the precision of two giant men. A crane would



pick up a single pile, lift it high into the air, lower it into place, and drive it down with a steam hammer. Then it would turn back for the next pile. About one o'clock only the pile for the last corner remained.

"And suddenly," one of the engineers related, "a part of the steel wall gave way and began to fall into the water, snapping steel cables, pulling beams out of the dike, and dragging a railway with it. In the course of two minutes 190 yards of the wall collapsed." With terror the workers and engineers looked on, not knowing what to do. Fortunately the entire wall did not fall; it was supported on one side by cables with which it was fastened to the dike. But on the other side the wall broke throughout almost its entire length.

Five hundred and twenty-seven piles fell into the water – five hundred tons of steel!

And how much labour was lost!

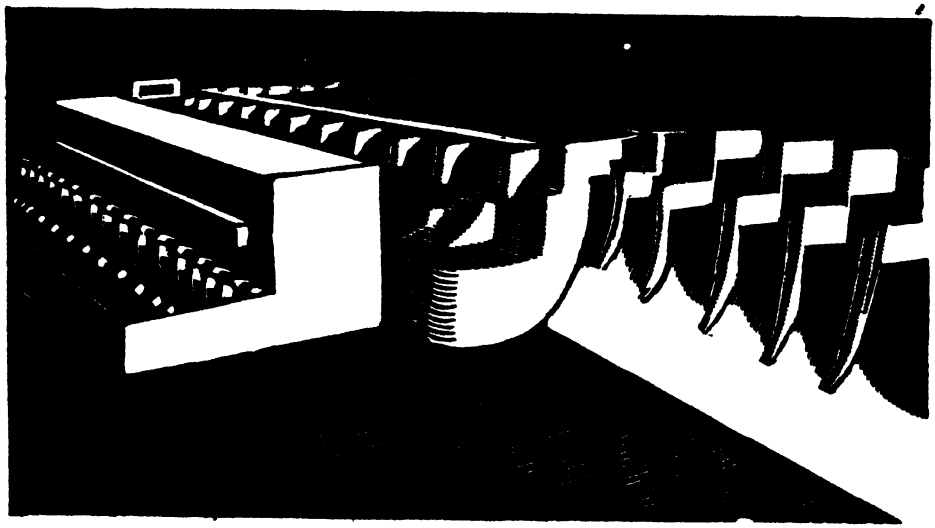
Why did this happen?

Because the steel piles stood on a sharp incline, and not on a level part of the bed of the river. To push them off this incline was not difficult for the power of the water.

Men endeavoured to fence themselves from the river by a steel wall, but the river pushed this wall over as if it had been an old fence.

To repair what the river had done this time was much

THE CONSTRUCTION OF THE DNIEPROSTROY DAM



BEFORE STARTING ANY CONSTRUCTION CALCULATIONS ARE CHECKED ON MODELS. THIS PICTURE SHOWS A MODEL OF AN ELECTRIC STATION AND PART OF A DAM.

more difficult than before. The submerged steel wall had to be raised from the bottom of the river. But it weighed five hundred tons. How can such a weight be lifted? It was decided to cut the wall into pieces under the water and to take it out in parts.

6. Fire Under the Water

To cut steel, and under the water at that! No one at Dnieprostroy knew how to do it. Divers equipped with oxy-acetylene pipes were brought from Leningrad. They

cut the steel, not with chisels nor with saws, but with a flame. This flame is most remarkable: it burns through steel and is not extinguished by water.

The divers descended to the bottom of the Dnieper with lighted burners and set to work cutting the steel wall. This work took several days. Cables were then attached to the piles and eleven capstans were set up on the bank.

Thus in pieces the wall was dragged out of the river.

This work required fully two months. Not until the 10th of September was the steel wall again in position so that the water could be pumped out of the enclosure.

7. Three Days' Work for a Farthing

What will Dnieprostroy give us when the river is finally conquered?

First six turbines and then four more will be established on the Dnieper. And every turbine will yield ninety thousand horse-power! Ultimately Dnieprostroy will give us nine hundred thousand horse-power.

The strength of one man may be reckoned as one-twentieth horse-power. This means that Dnieprostroy will give us eighteen million mechanical workers. And these mechanical workers will labour for little pay.

Do you know at what rate electrical energy will be sold by Dnieprostroy? At the rate of one farthing for one kilowatt-hour. But what is a kilowatt-hour? It is approximately three days' work of a strong man.

A farthing for three days' work. This is what each mechanical worker will cost us at Dnieprostroy! This means that it is profitable to build hydro-electric stations. And we shall build them.

We already have five large hydro-electric stations at work: Volkhov (near Leningrad), Zemo-Avchalsky, Erivan, Lenin (all three in the Caucasus), and Kondoposh (in Karelia). They give us one hundred and ten thousand horsepower.

There are six great hydro-electric power stations under construction: the Dnieprostroy, Svirsky, Rionsky, Gizel-Donsky, and the Dzoragatsky. We shall soon begin work on three large stations in the Caucasus and Central Asia. But how many smaller stations have been constructed and will be constructed! And all of our hydro-electric power stations will save for us between three and four million tons of coal every year.

v. THE DEAD WORK

1. The New Don Basin

WHERE are the majority of our coal mines?

In the Don Basin.

How much coal did they give at the beginning of the Five Year Plan?

Twenty-seven million tons a year.

Only? But in order to fulfil the Plan we need seventy-five millions![1]

What is the matter then? Have we made a mistake, or what? Perhaps the whole Five Year Plan will have to be formulated again. If we have made a mistake here, this is what may happen: we shall construct factories and then discover that there is no coal with which to run them. And they will make us a laughing-stock for the whole world.

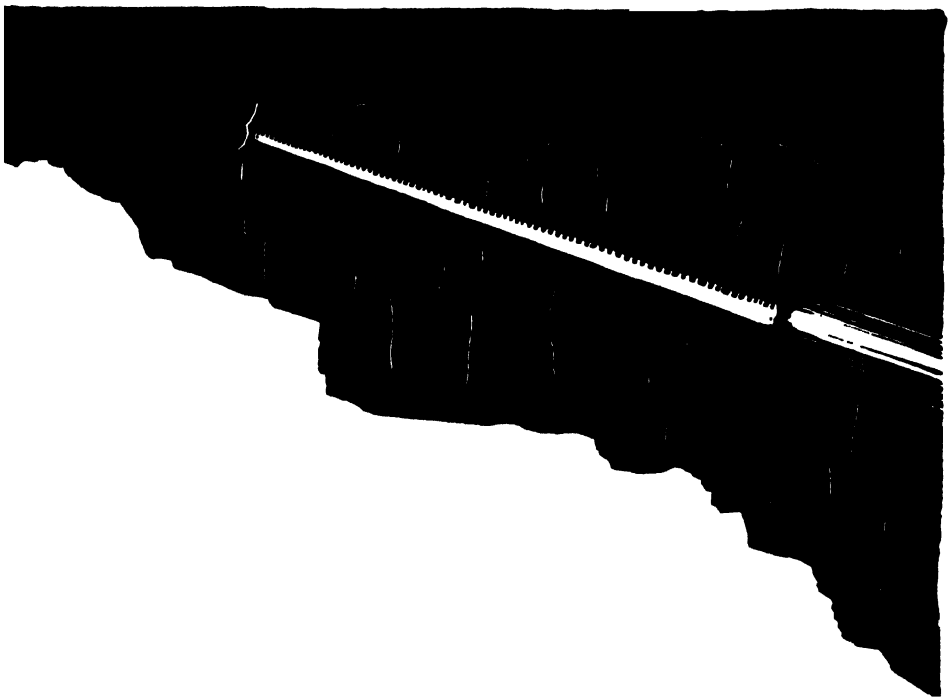
No, this must not be permitted.

The task must be fulfilled at any price.

But how is it to be done? And can it be achieved?

[1] According to the Five Year Plan approved by the Congress of Soviets it was proposed to raise the output of coal to seventy-five million tons a year. Now the task has been increased to one hundred and twenty millions. The Five Year Plan in coal will be fulfilled in three years.

Engineers tell us that it is possible. They say that in



many mines we still work by hand, without machines. They say that an American miner produces five times as much coal as ours. Is this because the American miner works harder? No, certainly not. The matter is easily explained: the machine aids the American miner.

In many of our mines the work still follows antiquated methods – with his own strength the miner strikes the coal with a pick. In America the pick is almost forgotten. There the miner operates a machine which chops out the coal.

Our miner bores into the coal with a hand-drill. The American miner watches an automatic hammer pierce the coal under its own power.

Our miner harnesses himself, like a horse to a sleigh, and straining himself drags the coal to little trucks. In America the coal runs along a kind of trough to its destination, is lifted by the hands of a loading machine, and in an instant is emptied into the waiting truck.

Up to the present time our mines have been stables. In them with drooping heads live quiet and gentle horses which never see the light of day. But in America electric engines long ago replaced horses. These engines dash rapidly along the passages of the mine, pulling trains of little trucks to the lifts.

In our mines all is darkness. Only occasionally is the gloom broken by a tiny light – the lamp of a miner. In America the mines are always illuminated by electricity. They are as light as a room. The miners even carry electric lamps on their caps.

Why could not our mines be equipped in the same way? And we will so equip them. Already some of them are no worse than the American. Already drilling machines and automatic hammers work for us.

At the end of the Five Year Plan the Don Basin alone will have 25,000 modern drills, 3500 conveyers, 80 electric engines, and 100 loading machines.

Not only shall we transform the old mines, but we shall also put down tens of new ones. By 1933 the old Don Basin will exist no longer. A new Don Basin will have taken its place.

2. We Shall Force the Dead to Work

How much coal will the new transformed Don Basin give us in 1932–33?

Fifty-two-and-a-half million tons.

And how much do we need?

At least, seventy-five million tons.[1]

Even this is insufficient.

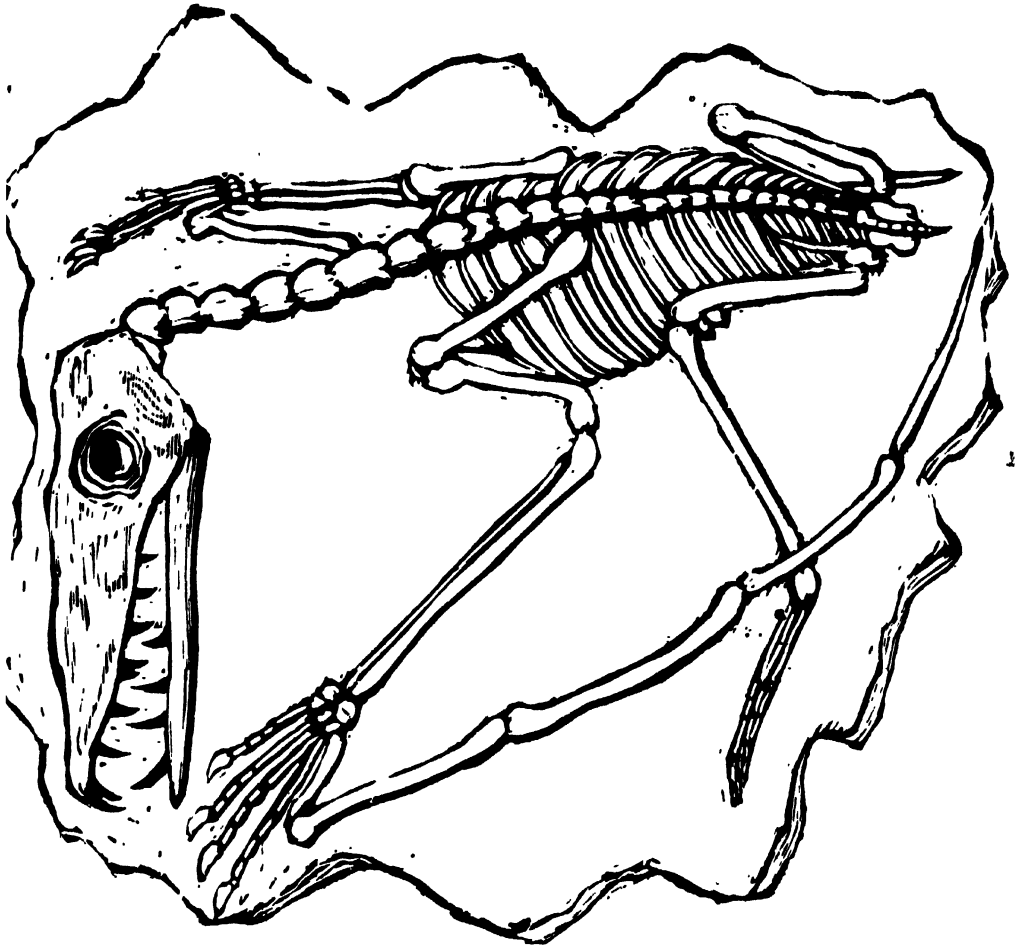
Whence shall we get the missing coal?

Let us ask the scouts.

They tell us that we have another coal basin, in comparison with which the Don Basin is a dwarf.

In far-away Siberia stand the Altai Mountains, whose peaks are covered with eternal snows. And along the slopes grow dense and dark coniferous forests. From the main range long ridges reach out into the Siberian and Kirgiz steppes. At the foot of these mountains lie great beds of

[1] In the current year (1929-30) Don Basin will already give forty million tons. At the end of the Five Year Plan, according to the new estimate, it will give seventy-three million tons, and the entire output of coal will be raised to one hundred and twenty million tons a year.



coal. In prehistoric times this very spot was washed by an arm of the sea. Gigantic ferns and horse-tails grew along the shores. And in the midst of the ferns clumsy, heavy beasts with long necks and little foolish heads made their way. A single beast was as tall as a four-story house.

But years rolled by, the beasts perished, the water dried up, and the sea was converted into a vast swamp. Then

the swamp, too, filled with sand, received deposits of clay, and disappeared. The remains of the swamp grass, the ferns, the horse-tails, rotted under the layers of sand and clay, became black, and turned into coal. And to this cemetery we intend to go, drag the dead out of their tombs, and force them to work for us.

What is the name of this coal giant in comparison with which the Don Basin is a dwarf? It is called the Kuzbas or the Kuznetz Basin. In the Don Basin the layers of coal are thin: there a seam twenty inches in thickness is thought good. But in the Kuznetz Basin layers eighty inches thick are not regarded as unusual. Indeed, strata seventeen yards in thickness may be found. These strata, moreover, lie near the surface of the earth and the quality of the coal is better.

What is the matter then? Why do we not concentrate on the Kuznetz Basin? But we shall! In the Don region we will double the output, but in the former we will triple it. The fact is that in the Kuznetz Basin we are only beginning. Kuzbas is only a youngster. There we have few mines and few railroads and as yet no large electric stations. And the one depends upon the other. How can we run drilling machines, let us say, or electric engines, if there is no current? This means, unfortunate as it may seem, that during these five years we shall not be able to take from the Kuznetz Basin all that it is able to give.

PIT-HEAD WINDING GEAR

Nevertheless we shall do much. Our very largest mines will be in Kuzbas. Mine No. 1 will give two-and-a-half million tons a year and mine No. 2 will be even more productive: it will give six million tons.

3. Raw Materials from Flesh and Bones

Of coal we shall have enough. But here is something we do not seem to have thought of.

Where are most of our factories and mills? In Leningrad, in Moscow, in the Urals, in the Ukraine.

And where is our coal?

Far to the south in the Don Basin and yet further away in Siberia in the Kuznetz Basin.

To the Urals we shall bring coal from the Kuzbas, to the Ukraine from the Donbas. But what are we to do with Moscow and Leningrad? Must we transport coal such a distance, over a thousand miles? Think of the cost of transportation!

What an absurdity! Coal in one place, and the factories which need it in another. But we are not to blame for this. The manufacturers who built factories without any plan are responsible.

However, they did have a plan: to extract as much

profit as possible. Very often they built factories, not where coal was cheap and not where raw materials were cheap, but where *people* were cheap. Before the revolution the peasants held little land, they had little to eat, and they were ready to work for farthings. So the manufacturers built factories near this human raw material of flesh and bones.

But the coal? They needed less coal than we do, because it was not profitable for them to buy many machines. A machine which was regarded as profitable abroad, often proved unprofitable to them. And why? Because a machine on two legs worked more cheaply. Nevertheless they did have some machines.

Whence, then, came the coal for these machines?

It was imported by sea from abroad.

Their own country had plenty of coal, but they bought coal from England!

Or they did yet worse – they burned the forests.

4. Should Wood be Burned?

The forest should not be burned. Wood is not a fuel, but a valuable material. Instead of destroying trees we should plant them. Read what S. Marshak writes:

Planting forests,
What plant we?

Masts for sails
To scour the seas.
Rafters we plant,
Sleepers grow,
Bridges for roads
Where rivers flow.

For planting forests?
What is the prize?
Wings that are light
To climb the skies.
Windows we win,
Floors that we need,
Tables, paper,
And the book you read.

In fifteen or twenty years no one will think of burning such valuable raw material. The word "firewood" will simply be forgotten.

And what shall we burn?

We shall not burn anything.

But how shall we manage without fires?

In place of fires an entire city will be served by one large heating plant. In this central station, not wood but coal or peat will be burned. Thence hot water will flow

MEMORIAL

through pipes to all the houses. Already we have such heating stations in Leningrad. And already many homes receive heat through pipes from central plants.

5. Mines Near Moscow

This means that wherever possible wood must be replaced by some other fuel.

What shall then be done with the Leningrad and Moscow factories if we may not burn wood? Coal will have to be brought from the Don Basin. But have we not in the north some other kind of fuel with which it would be possible to replace in part the Don coal?

Let us ask the scouts and see what they can tell us.

The scouts say that there is coal near Moscow. Can this be true? How did we happen to overlook such an important fact?

We overlooked the Moscow coal because it is of poor quality. Formerly we paid no attention to it whatsoever. It gives only one-half the heat of the Don coal, and with the Kuznetz coal it is not to be compared.

Now, however, the engineers have discovered a method of burning this coal profitably.

But what about Leningrad? What is the situation there? Again let us ask the scouts.

A swamp, say the scouts.

A swamp? What kind of a swamp?

Peat, say the scouts.

Well, suppose it is peat. What good does that do?

This, that peat is also a fuel. And it is not altogether bad. We must only know how to get at it.

6. Peat Saves Moscow

In 1918 Moscow was cut off from the Don Basin. Transportation of coal was stopped. The Moscow electric stations burned their reserves. Only one station, *Electroperedacha*, worked without interruption and saved the city. It used peat. And there is peat all around Moscow – as much as you please.

Then they thought of building another peat-burning station near Moscow. In the spring of 1918 the work of digging out the peat in the Shatura swamps was started on. The workers lived in mud huts, went hungry, worked in water up to their knees, and suffered from heat and mosquitoes. But they carried on. In the Baltic factory in Leningrad they found a turbine generator – a machine for producing current. They took a steam boiler from the battleship *Novarin*. They improvised a new furnace for the

V. R. NARLA

burning of peat. They stretched wires from Shatura to Moscow.

And, finally, current was sent over these wires. Lamps flashed on along the streets of Moscow. Lathes in the factories began to turn. Peat saved the city.

7. Green Coal

Peat – green coal – saved Moscow. It will save us now also; it will help us carry out the Five Year Plan. For we have tremendous reserves of peat, the foremost in the world. Around Leningrad and Moscow peat swamps extend for hundreds of miles on all sides. Moss, hillocks, water, shrubs, low-growing birches, occasional dark huts, and soft dirt roads, along which travel is possible only in very dry weather – this is the country of peat. We must conquer it. But we cannot conquer it without machines. In many places we still dig peat, as of old, with shovels: here and there we still tramp peat with our feet: we throw peat into a hole, pour water over it, and then with nothing but shirts on tread and knead the dough of turf.

By these methods we cannot go far. We need steam shovels, excavators, and mechanical kneading and moulding machines. Excavators, of course, are not suited to all

conditions. They cannot work in stump swamps. And this kind of swamp is most common. But Engineer Klasson has discovered an excellent way of dealing with this situation. Instead of digging peat, he has suggested that we wash it out of the roots and hillocks with a powerful stream of water. The method seems absurd at first sight. Men walk through a swamp and water it from a hose, as if it were not a swamp but an asphalt pavement. And immediately following the men go two cranes. One carries a hook from which a peat pump is suspended; the other is armed with steel jaws. The former plunges its pump, like a trunk, into the peat gruel and pumps it out of the swamp. And the crane with the jaws accompanies it, pulling out the stumps like a great hand picking ticks from brown fur.

But to get peat is not enough. It must be dried. For it absorbs water like a sponge. And it is precisely here that we have our greatest troubles. As yet we do not know how to dry peat well.

How is peat dried?

The peat is made into little bricks which are stacked in piles. The sun and wind do the rest. But this method requires a great deal of time. Even then some of the water remains in the peat. We must learn to dry it artificially. Already we are working on this problem. At the station *Electroperedacha* a factory for experimenting in removing the

water from peat has been built. Here methods of converting ordinary peat into dry bricks and powder have already been discovered. And such artificially dried peat burns quite as well as coal.

8. Ponds of Oil

"The air was unnaturally stifling. I felt I was being poisoned. I threaded my way through a forest of towers

WASHING OUT THE PEAT WITH

streaming with oil; I saw before me whole ponds of greenish-black oil. They seemed bottomless; and the earth, with everything on it, including the people, was splashed and drenched with dark oil. Greenish puddles everywhere made me think of decay; and under my feet the sand did not grate – it mumbled."

Who says this? And where is oil poured over the ground as if it were water?

The account is from Gorky. He is relating, however, not what exists now, but what existed in the Baku oil fields under the former owners. They made no effort to conserve this valuable resource. They did not guard it in iron cisterns as now, but simply collected it in open ditches. They drew it out of the wells in open pails. As a conse-

A STRONG STREAM OF WATER

quence much oil evaporated, and quantities of spirit were lost for ever. But the owners of the fields gave no thought to this. They were merely interested in getting as much oil as possible out of the earth as quickly as possible and selling it as soon as possible. Why spend money on costly cisterns, on foreign machinery, they argued, when in a month or so one can grow rich and become a millionaire? Seize, rob, plunder! And what would happen when the reserves were exhausted, when the earth ceased to give oil, was no concern of theirs.

We cannot reason in this way. We did not take the oil from the capitalists in order to spill it upon the earth.

We must organize everything efficiently. We must put the oil into cisterns. We must take the oil from the earth, not with open pails, but with pumps. We cannot afford to lose petrol – we shall need it for our aeroplanes and motor cars.

9. Steel Pilgrims

We have already bought many pumps from abroad (in the oil fields they are called "pilgrims") and other machines. And during the coming five years we shall buy still more.

Gorky visited our oil fields recently, and he says that they have been transformed beyond recognition:

A FIRE IN THE OIL FIELDS. THE OIL WAS NOT GUARDED OR PROTECTED

V.R NARLA
D. P.R.I.
Acc. No.

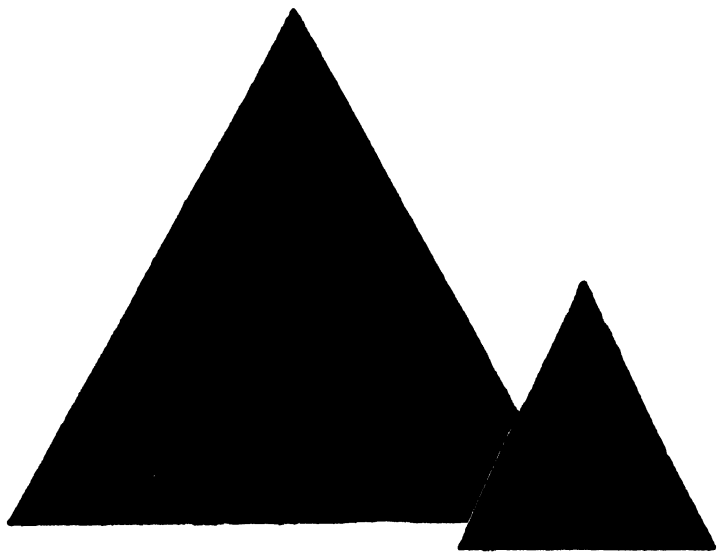
"Over an infinite expanse of oil fields crouch iron pumps with clanking chains; the great watch-towers of the past are disappearing; everywhere swing the clumsy 'pilgrims.' Almost noiselessly they pump the oil from the depths of the earth. A little wooden shed contains a junction of oil pipes, that reach out like a spider's web in all directions. . . . Nowhere can one see workers smeared with black oil. . . . Nowhere can one hear the shouting and yelling of foremen, only the clinking and clanking of iron upon iron, as the 'pilgrims' bow to the earth."

During the current five years we must increase the production of oil to twenty-six million tons. In 1927–28 we produced only twelve millions.[1] We shall not burn oil as they did formerly. We know that oil is not a fuel, but a raw material. From it we shall get petrol for aeroplanes and motor cars, heavier oil for tractors.

If we are to burn anything at all, we should burn, not the oil itself, but the residue left after petrol and paraffin have been extracted. But even this residue should not be burned, because a way has been discovered of extracting spirit not only from raw oil, but from the residue as well. According to the Five Year Plan we must build sixty

[1] According to the revised plan the production of oil is raised to forty million tons.

up-to-date refining plants. From the residue we shall also get machine oil. Since we need great quantities of this oil, we shall only burn what remains after all useful spirits and oils have been extracted from the crude oil.



IN 1927-28 WE PRODUCED 35·4 MILLION TONS OF COAL A YEAR. ACCORDING TO THE FIVE YEAR PLAN THE MINING OF COAL WILL BE RAISED TO 75 MILLION TONS. THE PLAN WILL BE FULFILLED IN THREE YEARS

VI. AN ELECTRIFIED COUNTRY

1. There is a Difference Between Coal and Stone

In order to get energy for our machines we shall dig deep mines, we shall build dams across rivers, we shall pump peat out of swamps, we shall suck oil from the earth.

But this is not all.

The getting of fuel is only half the task. To take coal from one place and put it in another is not enough. What is gained, if the coal remains idle? We did not bring it out of the earth for it to be idle. We dug it for it to do work for us. How then can we force it to work? How can we force a piece of coal which lies immovable on the ground to work? The case of water was more simple. Water flows. If a wheel – a turbine – is placed in its way, the water turns it. But a piece of coal is as inert as a stone.

There is a difference, however, between coal and stone, a very great difference: coal will burn. Coal can be burned under a boiler and be made to generate steam.

And a blow of steam, like a stream of water, can turn the

wheel of a turbine. It can drive the piston of the steam-engine.

What then is our conclusion? To mine coal is not enough: we must build power stations with steam boilers, with engines and turbines.

Where shall we build these power stations?

We might build one in every factory.

Then we might build a large power station to serve, let us say, one hundred or even two hundred factories.

Which method will be the more profitable? What do you think?

2. One or One Hundred?

My opinion is that a single large power station is more profitable than one hundred little ones.

Just imagine the situation: for the little stations we should need one hundred buildings, and for the large station only one; for the little stations we should need one hundred railroad branches to bring the coal, and for the large station only one.

For the little stations we should need perhaps one hundred turbines, and for the large station only one. The latter would, of course, have to be a hundred times as strong as each of the

former. But this does not mean that it must be one hundred times larger and heavier. The largest turbine – tens of thousands of horse-power – occupies very little space: it is housed in one room.

In the large station there will be fewer workers than in all the small ones. For whether the worker looks after a large or a small machine is a matter of indifference to him.

It may even be easier to care for a large machine. It is equipped with all kinds of improvements for repairing, for putting in the fuel, for loading the ashes. But why cannot these improvements be installed in a little power station? The expense is too great.

You can now see how many more trumps a large station has than a small one. But I have left one trump to the very last.

Guess what it is!

Since you cannot guess, I will tell you.

Where must we build the little stations? In factories. A large station we can build wherever it is most profitable. And where is that? Where there is fuel, of course.

We shall build a peat-burning station in a peat swamp, a coal-burning station near a coal-mine. This is clear. There is nothing to argue about here. Why should we transport coal or peat over a railway when it can be burned on the spot, converted into electric current, and sent wherever

desirable – to all the surrounding factories? Already we know how to send electric current three hundred miles, and in time we shall learn to send it yet further.

3. Union of Factories

Take a pair of compasses and a map and draw a circle with a radius of three hundred miles. If you construct a large electric power station in the centre, it can supply all the factories which lie within the circle with power.

What is the result?

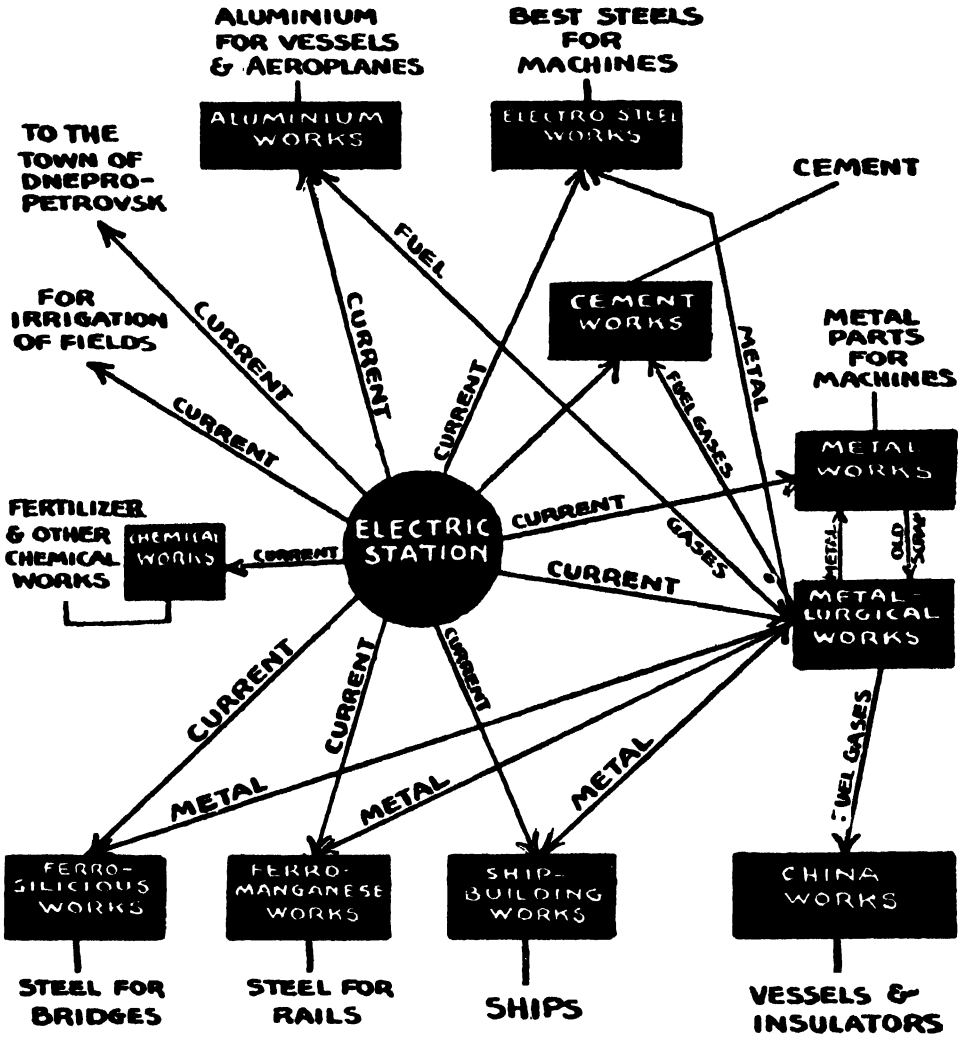
A union of factories. And in the middle of the union is the electric power station.

According to the Five Year Plan we shall build forty-two regional electric power stations. Each of these will serve a union of factories.

The very largest union will be on the Dnieper, around Dnieprostroy.

Look at the diagram.

You see the electric power station in the centre. About it are the various works served by it – factories of iron and aluminium goods, chemical works, shipyards, and so on. The station sends current to all and aids all. But the factories



THE DNIEPER UNION OF FACTORIES

also aid one another. The smelting works produces hot gases in its blast furnaces. Since it does not need these gases, it gives them away to other factories – cement, aluminium, porcelain factories.

Remember, according to our calculations Dnieprostroy will give to us eighteen million mechanical workers. This army of helpers will not remain idle. We shall compel it to smelt iron, steel, and aluminium, to build steamships, to bake cement and porcelain, to manufacture chemical products, to produce fertilizers for the fields, to illuminate cities, to irrigate arid lands. Every living worker in the factories of the Dnieper Union will be assisted by seven hundred mechanical helpers.

And such a union we shall organize around every great electric power station.

4. An Electrified Country

In time we shall link all of these unions into one vast electric system. First of all, we shall stretch wires from Dnieprostroy to the Don Basin. These two regions will grasp hands in friendly fashion. When Dnieprostroy requires current, Donbas will give it. When the Don Basin is in need, Dnieprostroy will come to the rescue. And this will occur every year.

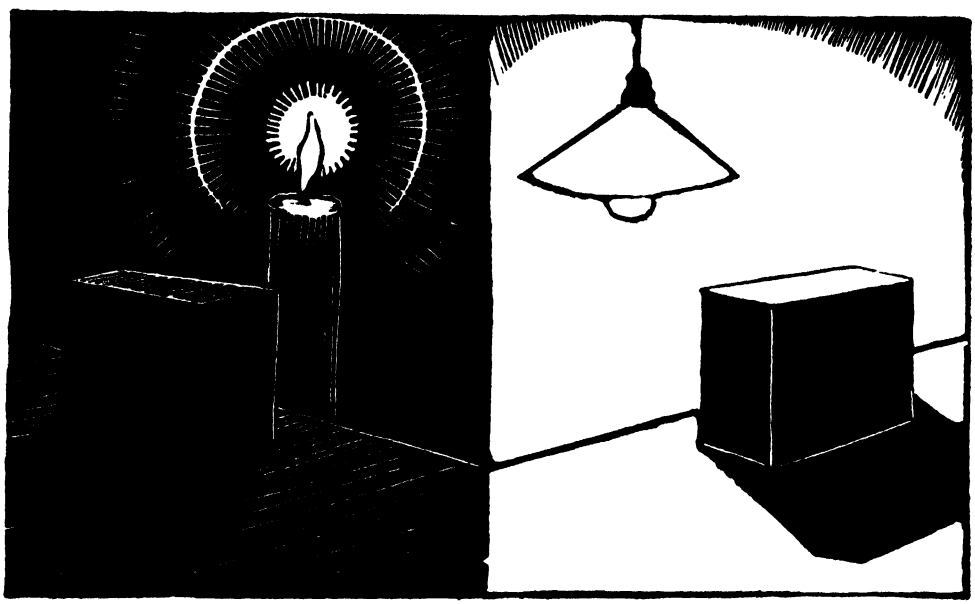
In the spring when rivers overflow, the underground waters also become turbulent and strive to flood the mines. Day and night electric pumps must work to remove the water. To stop the pumps would mean disaster. Small

wonder then that the Don Basin has insufficient current and requires it unto death. But at the same time the banks of the Dnieper are full, the water is high, all of the turbines are working, and an excess of electric energy is produced. Consequently Dnieprostroy aids the Don Basin by sending current for its pumps.

But when the river falls, when the turbines lack water, when the Dnieper factories are in need of energy, Dnieprostroy signals the Don Basin.

Help!

And then the current flows in the other direction along the wires: from the Don Basin to Dnieper factories. For the electric stations of the Donbas depend on coal.



But this is only the beginning. The time will come when the rural districts will be electrified. In the towns electricity has already won the battle with paraffin; now it is the turn of the village. Light without fire or soot, steady, bright, and safe, will flash through the village streets. Thousands of hours will be reclaimed from the dark winter days, from the long autumn nights, by the electric lamp. The peasant will have more time for work, for reading.

And within fifteen or twenty years electricity will become as common as air or water.

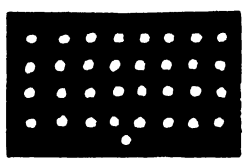
Everywhere both energy and light can be obtained in any quantity. Electric machines will work both in the factories and in the fields. Electric trains will dash over steel rails. Electric ploughs will till the soil. Electric harvesters will gather the harvest. Electric motor cars will carry the labourers to work.

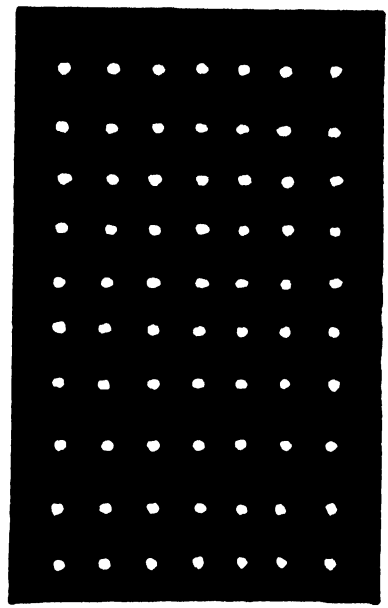
Everywhere – in the street, in the home, in the factory – noiseless, nimble, and strong electric servants will work for men.

SPARK: HALF-MILLION VOLTS

AT THE BEGINNING OF THE FIVE YEAR PLAN OUR ELECTRIC POWER STATIONS PRODUCED 5·05 BILLIONS OF KILOWATT HOURS OF ELECTRICAL ENERGY PER YEAR

AT THE END OF THE FIVE YEAR PLAN WE SHALL PRODUCE 22 BILLIONS OF KILOWATT HOURS PER YEAR





AT THE BEGINNING OF THE FIVE YEAR PLAN EVERY FACTORY WORKER HAD 33 MECHANICAL WORKERS (THE EXPENDITURE OF ENERGY FOR EACH PERSON PER HOUR WAS 1·24 KILOWATT HOURS)

AND AT THE END OF THE FIVE YEAR PLAN EVERY FACTORY WORKER WILL HAVE 70 MECHANICAL HELPERS (THE EXPENDITURE OF ENERGY FOR EACH PERSON PER HOUR WILL BE 2·61 KILOWATT HOURS)

VII. TO ARMS! TO CONQUER METAL!

1. The Museum of the Future

There are museums of the past in which are preserved objects found in excavations. In huge glass cases, as if in coffins, stone weapons, bronze hammers, wooden chariots, fragile vases, precious stones with delicate carvings, quietly sleep. Then there are other museums, the museums of the present.

Heretofore there have been no museums of the future.

But now there is such a museum. Go to Leningrad, to Fontanka, to Chernishov Bridge. There you will see a great building, made of grey stone. Go up the stairs, get a pass from the official. With this pass go boldly forward.

In the first hall you will see a hundred draughting tables.

Perhaps there are more. On each table there are great sheets of paper, mathematical instruments, compasses, pencils, triangles, and drawing-pens. Behind the tables, standing and sitting, draughtsmen are at work. A whole army of draughtsmen. From above through a glass roof a pale white light falls upon the drawings.

But you are not yet in the museum. Go further.

The museum is to the left, beyond the little door.

Enter, but be careful. If you were to tread on the first hills of the Urals, you would crush the Nizhne-Tagil factory, you would destroy a railroad embankment.

On the floor before you is a great relief map, a portion of the globe greatly reduced. Green hills of papier mâché, a tiny bridge over railways, factory buildings of cardboard, and a little sign alongside – The Nizhne-Tagilsky Factory.

Make your way cautiously round this factory, proceed further. Presently you will come to Kazakstan. Take care lest you stumble over the little table, standing near the wall, and break the Riddersky lead and zinc mine.

This mine is made entirely of glass. If you light an electric lamp underneath, you can see all the floors at once, all the underground galleries, the pumps for the removal of water, the shafts for the raising of ore and workers, the shafts for ventilation. It is all drawn in Indian ink on glass plates – a plate for every floor.

From Kazakstan go back to the Urals. But on the way stop and look at the two-story house of a workers' village. This structure stands on a high pedestal in the centre of the room. In order that you may see better what is going on, the wall is missing on one side. The rooms are light and clean. On the beds are pillows and blankets. And the whole

room is no longer than a pencil and would fit into your pocket.

Let us go further. On a wall is a large picture. A metal works. A battery of coke ovens. Above the ovens are clumsy coal towers, like the towers of a prison, blast-furnaces with dizzy steel bridges over them. Further is a city radiating from a centre as if it were placed on the green ridges of a huge fan. And beneath it is a little sign – Magnitogorsky Factory.

With such pictures all the walls of the museum are covered. Here is the Telbesky Factory, and the Dnieper Union, and the Stalingrad Tractor Factory, and the Rostov Agricultural Machine Factory.

But the most interesting project of all is in the glass cases which cover the tables. In these cases are preserved the drawings and plans of factories which are now being built. The thick black folders contain complex plans, calculations, figures, figures, figures.

Without all these figures there would be no factories.

All the drawings, of course, are not here, only the most important ones. For Magnitogorsky Factory alone thirty thousand sheets of plans were prepared. But what kind of museum is this? What is its name? This is the museum of the State Institute for the Planning of New Metal Works.

"RED STANDARD" KNITTED GOODS FACTORY IN LENINGRAD.
ACTUAL BUILDING AND MODEL

From morning till night work goes on in the Institute. Thousands of engineers calculate, draw, then calculate again. Here are builders of houses and builders of ships, experts on coal and experts on steel, mining engineers, river engineers, aeronautic engineers. Last year they prepared estimates for 107 factories; this year they are working on 170 factories. And these are not small enterprises. There are giants among them. For the workers of each of these giants, not villages, but whole cities with thousands of houses and tens of streets will have to be built. Nine of the largest factories will produce iron. There are only nine, but they will produce more iron than all the old factories put together. There are seven somewhat smaller factories. They will build tractors, motor cars, trucks, harvesters, turbines, electric motors. These are only the very largest. How many others there are! And they were all born in the museum of the future. In comparison with each of these factories the house on Fontanka in which the museum is housed is a small building. But really, is much space needed for human thought? Important human inventions have been born in the human brain and written down on scraps of paper. All the important laws of physics and chemistry can be written in one book and put into a pocket. But knowing these laws, man erects great buildings, crushes mountains, digs cities under the ground.

2. Why Giants?

But why giants? All we hear is giant factory, giant government farm – *govfarm*. Has everybody gone crazy over giants or what? Perhaps small factories are more profitable. This should be proved. We should take nothing on faith.

Why then do we need giant enterprises?

3. When the Multiplication Table Should not be Used

Solve the following problem. There are two factories. One is a hundred times as large as the other. The small factory burns one-and-a-half cwts. of coal an hour. How much coal does the large factory burn?

I know what you will do. You will take one-and-a-half cwts. and multiply it by one hundred. The result is one hundred and fifty cwts. The answer is then seven-and-a-half tons an hour.

Is this true?

False. Entirely false.

The large factory burns only one ton an hour.

How is this?

Why?

But the multiplication table!

BLAST FURNACE NO. 4 OF THE MAKEIEV FACTORY. THIS IS THE LARGEST BLAST FURNACE IN THE UNION AT PRESENT. LIQUID PIG-IRON IS POURED INTO THE TUB WHICH STANDS ON THE PLATFORM. THE TUB THEN GOES UP, TURNS OVER, AND POURS THE ORE STRAIGHT INTO THE MOUTH OF THE GIANT BLAST FURNACE

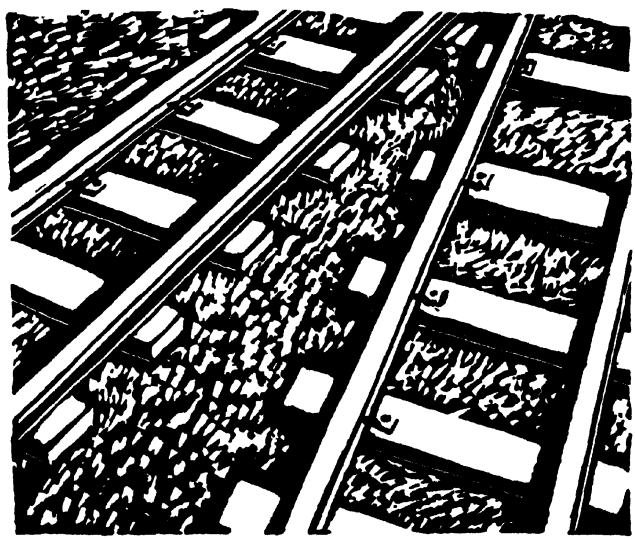
The multiplication table has nothing to do with the matter. Here the multiplication table cannot be used. The fact is that the large factory is equipped with a great steam engine of two thousand horse-power. And the small factory depends on a little engine of only twenty horse-power. The large engine is one hundred times stronger, but it is not one hundred times larger, and not one hundred times higher. Also it requires, not one hundred times more coal, but only twelve times more. The large engine is consequently more profitable than the small one.

4. Hands for Lbs.: Cranes for Tons

In both the small factory and the large factory loads must be transported from place to place. But where the large factory handles tons, the small factory handles lbs. For lbs. hands are sufficient, but for tons cranes are necessary.

To install cranes in a small shop would be foolish. If you wish to move something in your room, you pick it up and carry it. You would not think of carrying books from the table to the shelf with a crane. In a large factory it is a different matter. There without a crane you are as if you had no hands. If you carry everything yourself, how much

FEET FOR FEET –



RAILS FOR MILES

labour and time is lost! And sometimes, puff and blow as much as you like, you could not lift the load.

The large factory is therefore more profitable, because cranes and all kinds of improvements can be utilized.

5. Legs for Yards. Locomotives for Miles

And distances! A small factory can be covered in five minutes. A large factory is sometimes as big as a whole city. In a small factory no one counts his steps. In a large factory try just once to push even a small truck from one end to the other.

Obviously here it pays to lay sleepers and rails and to introduce locomotives, electric motors, and electric waggons. Feet for feet, but locomotives for miles.

6. When a Thousand is Better Than Two Thousand

This means clearly that from whatever side you approach the matter the large factory is the more profitable. It can afford both larger and better machines.

But there is yet one additional feature of the large factory which every one does not see. In it there is more order and less confusion, and every one has his own special

task. One sharpens an instrument, another works with it. One drives in the bolts, another screws on the nuts.

In the large factory things come running to the workers. Everywhere there are moving belts, roller tracks, elevated roads, turntables, chutes, spiral stairs, and cranes. Objects fly up, swoop down, rise through the ceiling, sink through the floor to the next floor above or below. Men stand still, but things move.

In the large factory the work is better organized. There a thousand men do more than two thousand scattered through many small factories.

On our front of factories and mills we shall go into battle with large detachments, with closed ranks. Proper organization, unanimity, discipline – these will give us the victory.

7. What Does Clement Say?

Clement is an American engineer. At one time he was a helper in the iron and steel industry. He is one of the most experienced American metallurgists at present, an expert on metals.

He was invited to the Soviet Union to give us the benefit of his experience and knowledge. What then does he say?

He tells us that, in spite of the fact that we have a few

old factories, our metal industry is in its infancy; that our metal industry has not yet even been born; that we are fortunate that we are able to build from the beginning.

What does he mean?

How can he say that we are fortunate because we have no factories?

What kind of an idea is this?

Is Engineer Clement making fun of us, or what?

No, he is serious. And he is right. It is better to build anew than to reconstruct ancient enterprises. In that same America from which he comes there are many old factories with antiquated machines. These factories work less efficiently than the new ones. Nevertheless, it would be unwise to abandon them, because many thousands of pounds have been put into them.

We are building our industry from the bottom. We can construct everything in the light of the very latest word in technology. Our factories will therefore be equipped with the newest, the strongest, and the best machines.

We build on a vacant lot.

Well, what of that? There we can build according to a plan.

8. Where the Kazak Used to Wander

"Magnetic Mountain. It is really not one, but four

mountains. From its base stretch the steppes. Here may be seen the summer hut of a nomad Kirgiz.[1] Here also lies iron ore in huge chunks three to four yards long, two yards wide, and two yards thick. It is of excellent quality, almost free of foreign admixtures, and is refined in the Beloretzky factory. During a whole year the factory can scarcely refine what is mined in two or three weeks. Enormous reserves of ore remain untouched."

This is an excerpt from a book on geography, published many years before the revolution.

Now, at the foot of Magnetic Mountain, where not so long ago Kazaks wandered with their herds, a huge metal works is being built.

In the old Beloretzky Factory there were 1700 workers.

In Magnitogorsky Factory there will be 6000 workers.[2]

The difference is not so great.

But in the old factory there were only 24,000 mechanical workers (1200 horse-power). In Magnitogorsky there will

[1] Sometimes the inhabitants of Kazakstan, the Kazaks, are incorrectly called the Kirgiz.

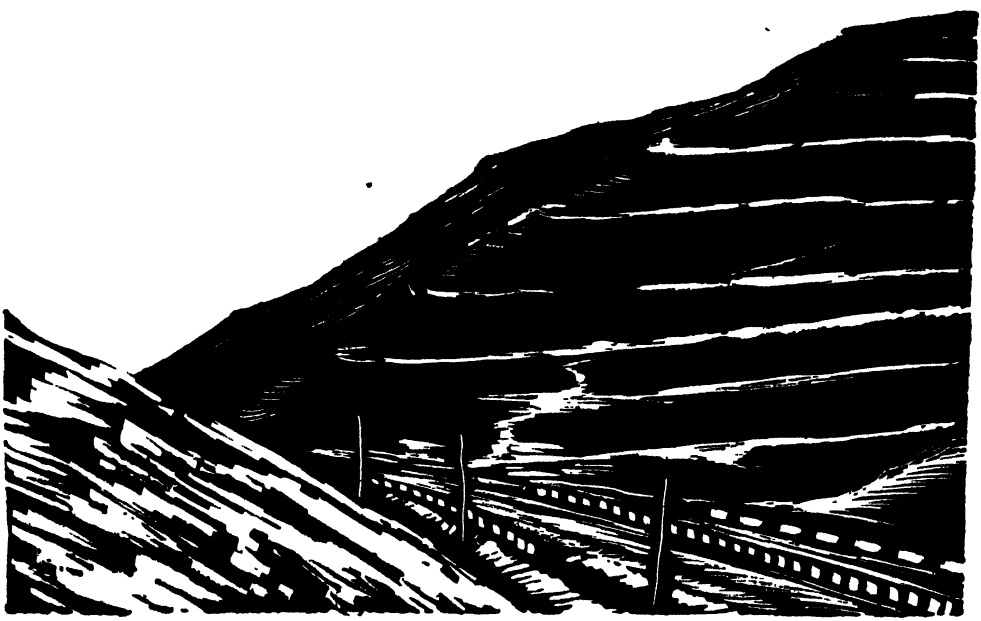
[2] This is according to the original plan. Now the project has been increased. Magnitogorsky Factory will give, not eight hundred thousand tons of pig-iron a year, as proposed, but two-and-a-half million tons. In the entire world there is only one such large factory – in America. The power of the electric station will be, not eighty thousand horse-power, but three hundred and twenty thousand. There will also be many more workers than was first contemplated.

be 1,600,000 (80,000 horse-power). The new factory will thus have almost seventy times as many mechanical helpers. This is the difference between the factories built before the revolution and those which are being constructed now.

What will the army of mechanical soldiers do at Magnitogorsky factory? What will be their task?

To take Magnetic Mountain, consisting almost entirely of iron ore, and convert it into steel rails, beams, plates, and rods.

How is this to be done?

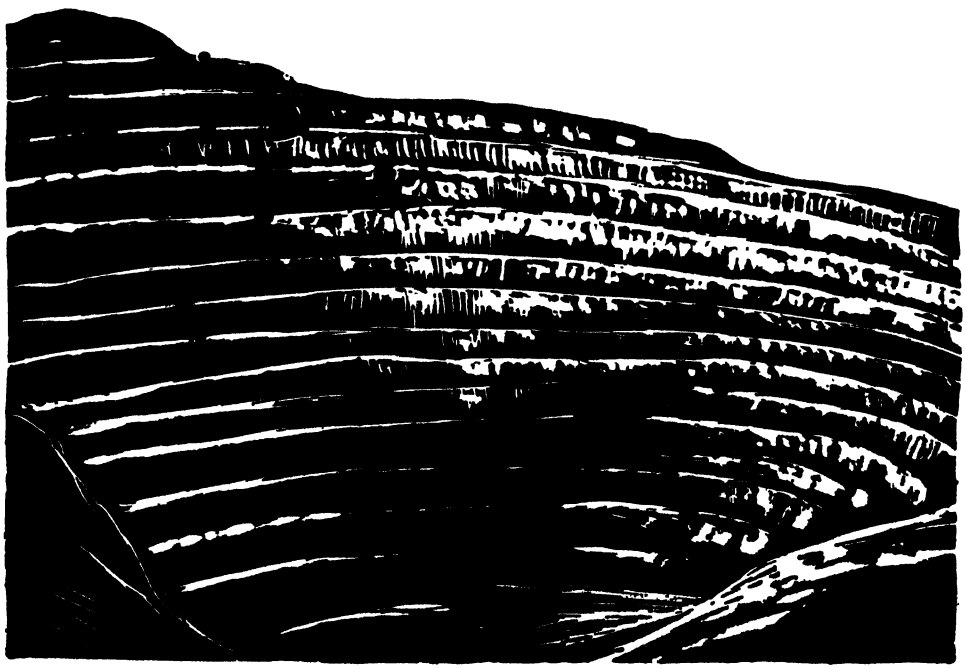


WITHIN A FEW YEARS ATACH MOUNTAIN WILL LOOK LIKE THIS. THE WITH DYNAMITE, TERRACE AFTER TERRACE. ALONG THE TERRACES RAILS

9. A Mountain Which will be Eaten up

Atach Mountain is one of the four peaks of Magnetic Mountain. On its slopes terraces are hewn out. Every terrace step is twenty-six feet high.

Along the terraces rails are laid over which electric trains move backward and forward. Here excavators work and load into cars the ore which is mined. This is the future Magnitogorsky mine. As yet the mountain is not eaten up. But soon workers will come with drills and dynamite, and Atach will shake from heavy blows.



WORK WILL BEGIN FROM THE TOP. THE MOUNTAIN WILL BE BLOWN UP WILL BE LAID. EXCAVATORS WILL LIFT THE MINED ORE INTO TRUCKS

What is that noise? Where are the cannons firing? people will ask.

No, they will be told, that is not the discharge of cannon. It is the dynamiting of ore on Atach Mountain.

Great iron beasts will eat up a huge mountain. Piece by piece, from terrace to terrace, they will gather up the ore. Lower and lower will the top of the mountain fall, deeper and deeper will the terraces eat into its body. Ton by ton the mountain will be dragged into the factory. And there in the flaming bowels of blast-furnaces crude ore will be smelted into iron and steel to be used in the building of our country.

10. Pies of Coal and Ore

When ore is mined, it comes out in large and small chunks. The latter are not suited for the blast furnace. If they should be thrown into the furnace they would fill all the crevices among the large pieces and would thus extinguish the fire. The result is the same as if we put charcoal dust instead of lumps of charcoal into the chimney of a samovar.

But what is to be done with the small pieces of ore?

Shall we throw them away as formerly?

No, we shall not do this, because they are not rubbish, but good iron. We shall make the rounds of yards collecting iron junk. Iron is bread to us. Why then should we throw it away?

We must think of something else. We must find a means of converting small pieces into large ones. A method of doing this has already been discovered. Out of small pieces of ore we shall bake pies. The small pieces we will mix with coal dust and bake them in large cups. The coal will burn up and the ore will fuse together – into black pies. These pies will be put into a tub, and the tub will be sent over an inclined iron way to the very top of the tower. There the tub will turn over and pour the stack of pies straight into the mouth of the giant blast furnace.

11. An Unheard-of Machine

In one of the Leningrad papers the following item appeared recently:

"In the factories of Yugostal there will be installed a blooming furnace which has a productivity never before heard of in the U.S.S.R."

What a guess! It is a thousand miles off. This machine

is not a furnace at all. Nor does it even look like a furnace. And if as yet we do not all know what it is, that is because we have few machines, few factories. But within five years from now, not only a newspaper reporter, but also any schoolchild will know what it is.

What then is this "blooming" plant?

It is not a furnace, but a mill which makes long thin strips out of short heavy chunks of steel – rails and beams for construction. In the open-hearth section of the factory pig-iron is converted into thick steel moulds or ingots. These moulds must be stretched.

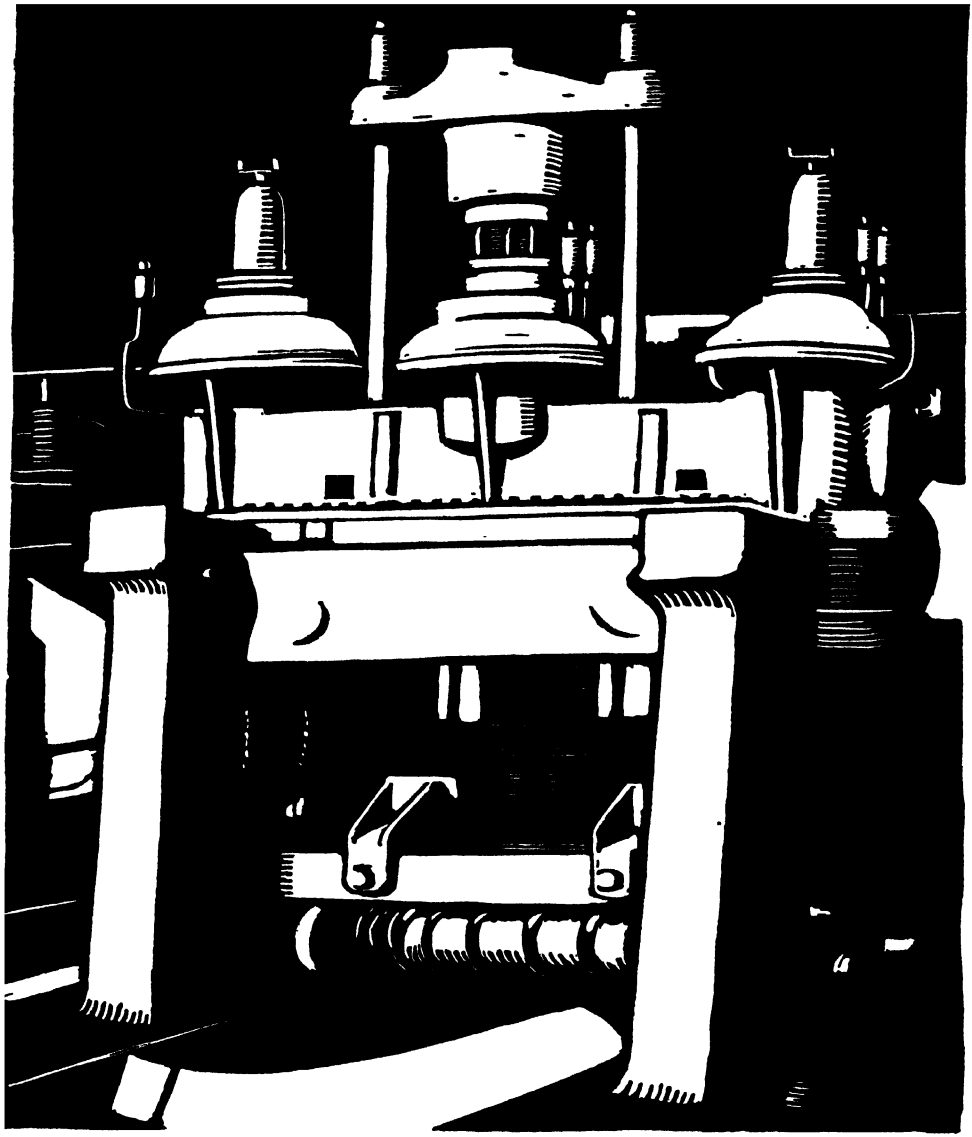
And how are we to do this?

We must roll the moulds between cylinders like dough under a rolling-pin.

And this is precisely what the blooming mill does.

A blooming mill is shown in the picture. It is a large, heavy apparatus. A little electric carrier picks up a red-hot ingot, approaches the mill, and deposits it upon a roller track. The rollers turn, and the mould goes directly into the jaws of a pair of cylinders. As it passes between the cylinders it is flattened and pressed out lengthwise. It is then turned on its side and sent back into the machine again.

Back and forth, back and forth, rapidly the mould is tossed, turned, drawn, squeezed.



THIS IS A BLOOMING MILL, A ROLLING LATHE. THE IMPORTANT PART OF THE LATHE IS TWO LARGE CYLINDERS. IN THE OPENING BETWEEN THE CYLINDERS THE FLAMING INGOT FALLS. THE CYLINDERS ROLL AND SQUEEZE THE INGOT. IN THE PICTURE THE INGOT AND THE UPPER CYLINDER CAN BE SEEN WELL. ABOVE STANDS THE MECHANIC. HE DIRECTS THE LATHE

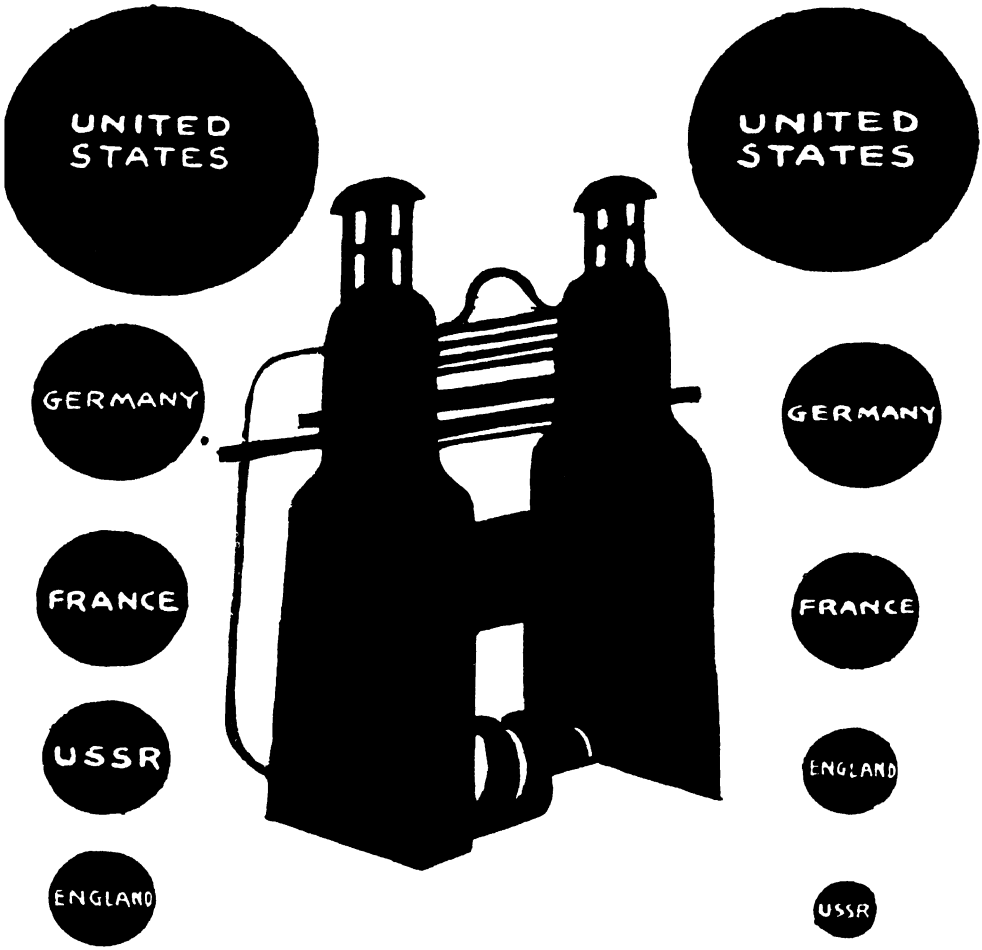
Within two minutes the mould grows thin and takes on the form of a flaming serpent. From a thick chunk of steel only sixty inches in length, it has been stretched until it is now almost seventy feet long.

And above on his captain's bridge stands the operator who directs the machine. How small he is! Yet he does everything. He plays with flaming ingots of steel as a juggler plays with rubber balls. And his hands are not burned. In two minutes the mould passes back and forth through the jaws of the blooming mill fifteen times. And it weighs several tons.

This is the kind of machine which we shall have in our metal works.

STEEL PRODUCTION

1933 UNDER ORIGINAL PLAN



IN THE YEAR 1922 WE PRODUCED 4·2 MILLION TONS OF STEEL, ONE-HALF THE PRODUCTION OF ENGLAND. ACCORDING TO THE ORIGINAL FIVE YEAR PLAN WE EXPECTED TO OVERTAKE ENGLAND BY 1933 AND ENTER FOURTH PLACE AMONG THE NATIONS. NOW THE TASK HAS BEEN INCREASED AND WE SHALL OVERTAKE NOT ONLY ENGLAND BUT FRANCE AS WELL

VIII. IRON WORKMEN

1. What Machines are Most Essential

Metal for machines we shall have.

Energy for machines we shall have also.

But what machines are we going to construct?

We shall need all kinds of machines. Many machines. For every type of work a machine has been invented. There are machines that sew boots, machines that weave, machines that churn butter, machines that make paper, machines that count, machines that make machines.

There are tens of thousands of machines. But which of them are the most essential?

The most essential machines are the machines that make machines. The reason for this is quite clear: if we have these machines, we can have all the others too. If we have blacksmith, locksmith, and lathe-making shops; if we have drillers, grinders, and polishers, then we shall be able to make any machine for any factory.

And this is the main thing.

Up to the present time we have had few such machines. We have had motor cars, but we have had no machines

which make motor cars. We have had tractors, but we have had no machines which make tractors. And that is why we have been forced to buy motor cars, tractors, and many other machines from abroad and to pay to European and American capitalists large sums of money.

This condition is intolerable. Our country works according to a plan, and the success of this plan must not depend on whether a certain Mr. Fox desires or does not desire to sell us machines.

Foreign capitalists are not pleased with our plans; they would like to hamper us in every possible way. They realize that we are building socialism, and under socialism there is an end to profits. But why then do they sell us machines at all? Only because they need buyers, because they need to dispose of their goods. "It is difficult," says Ford, the American millionaire, "to refuse to-day's for to-morrow's dollar."

We must be independent of the calculations of European and American capitalists. And that is why we must first of all construct those machines that make machines.

2. Things Which Make Things

At one time man made everything for himself by hand. Now things make things. Man places an instrument in

the iron hand of a machine and orders the machine to work.

Did you ever see a lathe?

With what does it work?

It works with a sharp tool like a chisel. But this tool is gripped, not in a human hand, but in an iron holder.

And the thing which the turning-lathe shapes is also not held by the hand of a worker. The lathe itself holds and turns it.

One often hears the statement made about a machine: It works like an iron man.

But this is not correct; this is nonsense. If machines could work only as well as men, it would be unprofitable to make them. A machine should work better than a man. It should be, and it is, a hundred times more agile, more accurate and more powerful than a man.

Man has only two hands. To a machine we can give as many hands as we wish.

Man cannot work with even two tools at the same time: a machine can work not only with two, but with tens of tools simultaneously.

Man cannot do two things at once. He cannot at the same time saw, chop, hammer, and shave. But a machine can.

There are automatic lathes. The worker feeds iron rods into the machine, and the machine does the work. First with

three "rough" tools it grinds a bolt out of the rod, and then with three "finishing" tools it trims the bolt. Thereafter a "figure" tool fashions a little head at one end and a "screw-cutting" tool cuts threads at the other. And now everything being ready, the turn comes for the ninth tool to perform its task. It is a "cutting" tool and cuts the finished bolt from the rod. All of this is done so quickly that you can hardly follow the movements of the lathe.

There's a machine for you! It uses nine tools. And do not imagine for a moment that one tool rests while another works.

They all work at once. While the cutting tool is removing the bolt from the first rod, the figure and screw-cutting tools are busy with the second, the finishing tools are occupied with the third, and the rough tools have begun on the fourth.

What human being could work like that?

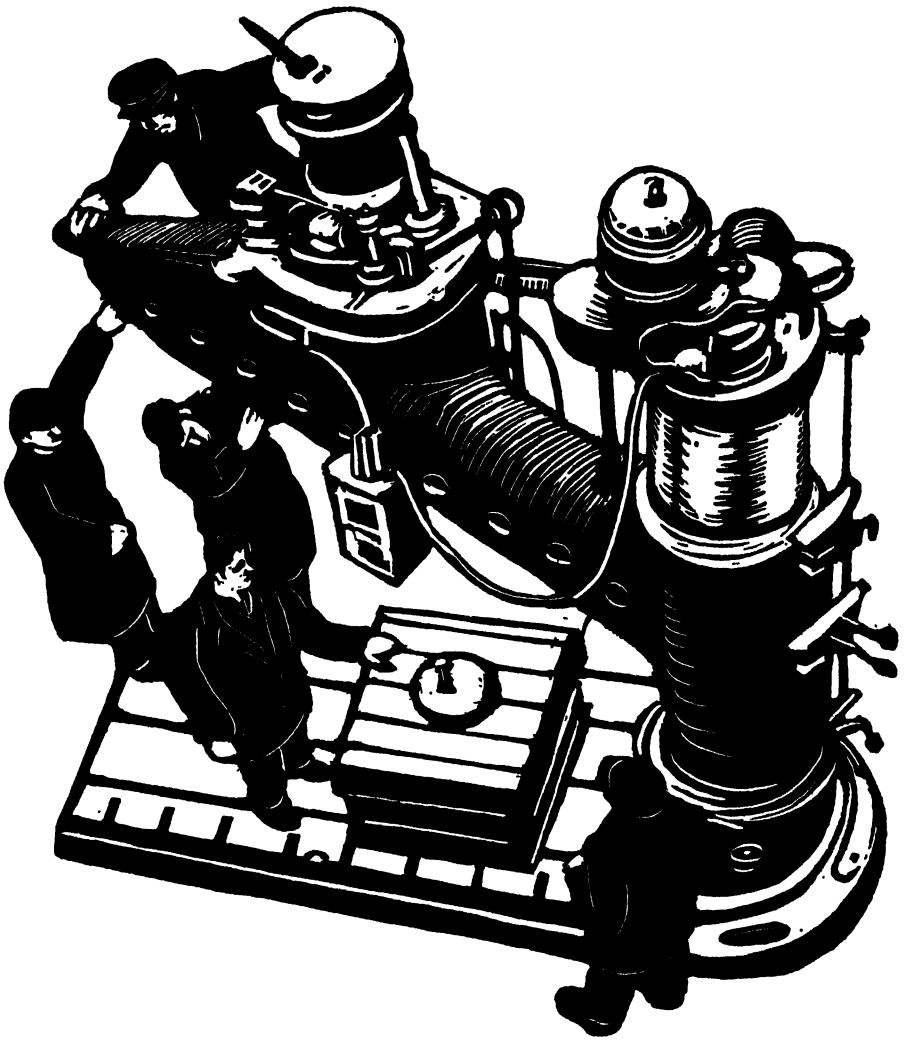
No, a machine is not an iron man.

And the speed with which it works! Sometimes the tool cuts so rapidly that it gets red-hot. For such work tools must be made of specially tempered steel.

And precision! Have you ever seen how blacksmiths work?

They work in twos. One hits the forge lightly with a small hammer to show where the real blow should be struck.

The other wielding a heavy sledge strikes with all his might. But is it possible for a man to strike with a sledge and with all his might precisely where he should? The stronger the blow the greater the chance of missing.



TESTING A NEW DRILL IN THE FACTORY "RED PUTILOVETZ"

But the iron blacksmith – the steam hammer – strikes without a blunder. The sledge with which it strikes glides between two iron rails. The stroke is well calculated and is directed with precision. There can be no mistake.

Rapidly and with precision the iron smith labours.

And what does the human worker near by do? He merely brings the material and removes the finished product. He is to the machine what a helper is to a skilled workman. The difference lies in the fact that the helper rather than the workman is in command.

3. Two Leningrads and Three Urals

We need first of all lathes, steam hammers, steel forges, presses, guillotines, saws. But if these machines are to work, we must have engines: steam and water turbines, Diesel engines, electric motors.

Have we got them?

Very few.

We lack engines probably even more than lathes. By the end of the Five Year Plan we must have six times as many lathes as now. And steam turbines must be increased eleven-fold. We shall also require water turbines in great numbers: we must have nine times as many in 1933 as we had in 1928.

To achieve these goals is a tremendous task. But we must manage it.

Otherwise the entire Five Year Plan will crash.

Just think how many water and steam electric power stations we have resolved to build! And each one of them will need turbines.

And steam boilers? We have few of them also.

Even those that we do have should be replaced. In our factories the boilers are little old men made in the last century. Out of every ten, three are more than twenty-five years old. The life of a machine is shorter than that of a man. At twenty-five years of age a boiler is an old man.

The little old men must resign! We shall melt them up in our furnaces. And they will come out new boilers, sound and strong.

We still require many machines. We must have locomotives, ships, lifting cranes, conveyers, electric waggons, and elevators to transport and raise loads: pumps and ventilators to drive water, air, gasolene, and oil through pipes: building machines, railroad machines, excavators, hewing machines, chemical apparatus, harvesters, threshing machines, and tractors. But can one enumerate all of them? We need a vast army of machines – coal-miners, ore-miners, loaders, carriers, builders, farmers, weavers, chemists, cobblers, millers, butter-makers. Some of these machines

will procure raw materials for us – ore, coal, sand, and stone. Some will transport raw materials to the factories. Others will work in factories and make finished articles out of the raw materials. Yet others will labour in govfarms and colfarms and produce bread for us.

Every one of our factories for the construction of machinery must make thousands of machines every year. We must begin to build many machines which we have never made in the past. Heretofore we have never constructed harvesters, motor cars, hewing machines, electric carts, seed drills, tractor ploughs, typewriters, railway machines, pneumatic hammers. We have to build hundreds of altogether new enterprises. And this is not so simple. Many new forms of industry we have to learn from the beginning.

There are then two difficult tasks ahead of us: to organize new industries and to increase the output of machines manyfold.

All of the Leningrad factories taken together cost one hundred million pounds. For the repair of these enterprises and the building of new ones in the city we shall expend during the five years about one hundred million more.

That means that by 1933 we shall have created a second Leningrad. We shall then have two Leningrads, three Urals, and two Ukraines.

4. A Factory is an Automaton

To every new machine which we build we shall assign a definite task, a definite programme: so many products an hour, so many a day, so many a year.

Also, the whole factory must work according to a plan.

If the tractor factory in Stalingrad should give us not fifty thousand tractors a year but only twenty thousand, the deficiency would be felt at once on another part of the front – in the govfarms and colfarms. If the blast-furnaces should produce not twelve million tons of pig-iron a year, but only six million, half of our factories for machine construction would be forced to close.

Each factory has its little plan. And of these little plans the large plan is composed – the Five Year Plan. In order to fulfil the large plan, all the little plans must be accomplished.

Every factory must work like an automaton.

But what must we do in order that every factory may turn out machines with the precision of an automaton? A machine is not a stick of chewing-gum. You cannot drop a coin into a slot and expect a finished machine to jump out.

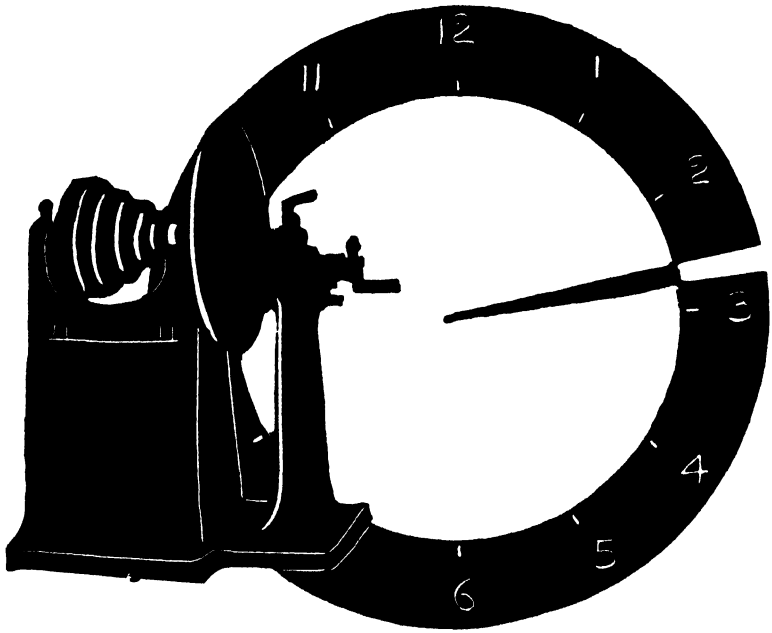
A large factory is a whole city in itself. Something is always certain to be out of order. Here the water has

stopped, there the light has gone out, in a third place a worker has been inattentive, in a fourth a tool has broken.

All of these things certainly occur, and yet a factory can be made to work like a machine, like an automaton which throws chewing-gum out of a slot.

Take, for example, the tractor factory in Stalingrad. Every six minutes a new tractor will come out of the assembling plant. Every day seventy car-loads of raw material will enter the factory gates. And every day seventy-five open trucks carrying tractors will leave the factory.

How like an automaton!



But how are we to do this? How are we to accomplish so difficult a task?

A tractor is not a trinket; it is composed of five thousand separate parts.

Each part must be carefully prepared, cast out of metal, forged from iron, finished on a lathe, drilled, planed, ground, polished.

And then all these parts must be assembled and attached to each other. Suppose they do not fit. Suppose someone has made a mistake: the opening is not where it should be or the bolt does not go into place. Anything like this may happen.

And if it does happen, if a mistake is made in one place, in another, in a third, then the plan of the factory miscarries and the entire Five Year Plan is endangered.

No, there must be no mistakes.

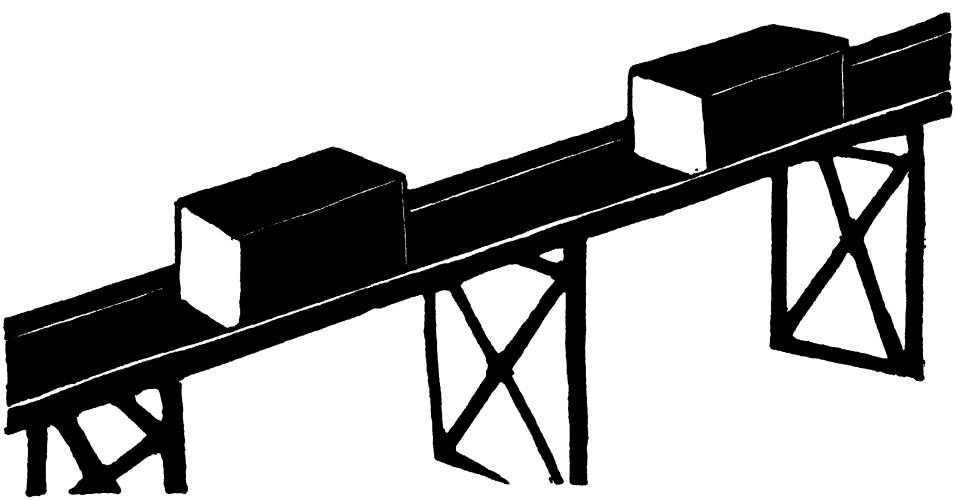
We must so arrange matters that mistakes cannot happen.

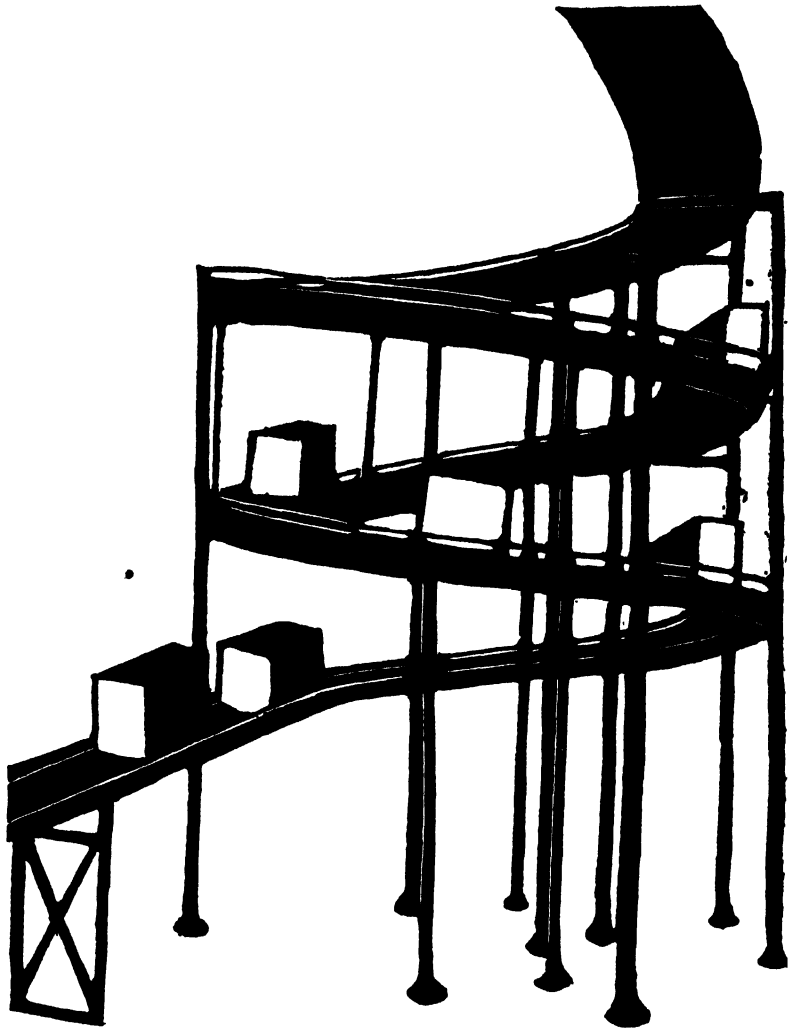
5. How They Work Without Mistakes

Imagine a huge hall fitted with rows of lathes, laid out in blocks, like the houses of a city.

Lathes, drills, planes, mills, presses, polishers – altogether 1360 different machines.

Between the machines are streets, hundreds of streets.





THE SIMPLEST METHOD OF DROPPING THINGS FROM FLOOR TO FLOOR

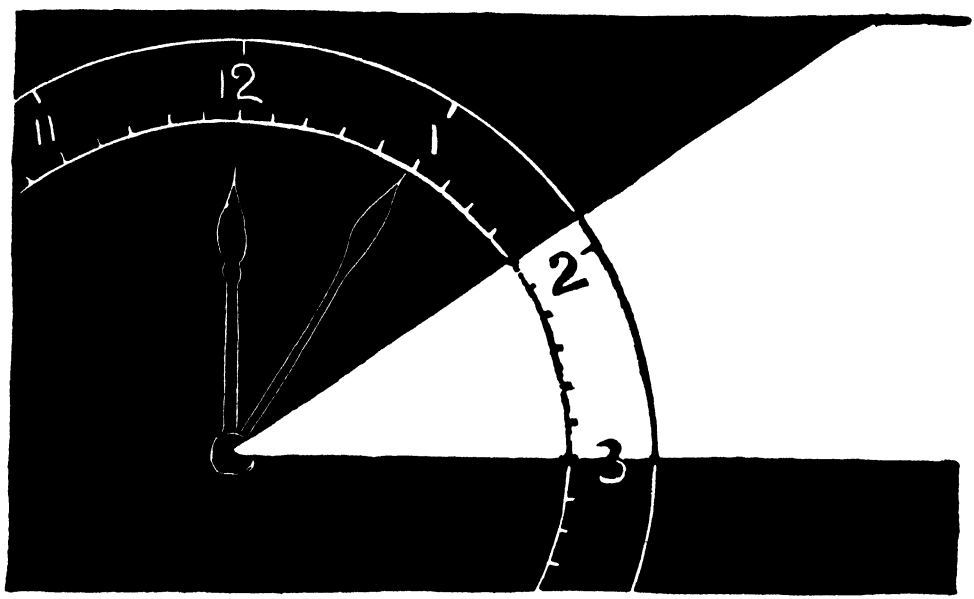
Along the streets in long chains move not people, but things – parts, details of a tractor.

In this city, of course, there are no tramways, no motor-buses.

Light things move over roller tracks, glide down long chutes. Heavy things go in carts on railways, or are slowly borne by moving platforms – conveyers. They all slide, glide, ride in one direction – toward the main street of the city. And on their way they stop at each machine as if at different houses. At one they are planed, at another ground, at a third polished. When a part reaches the main street, it is in order, finished, and ready to be built into the tractor.

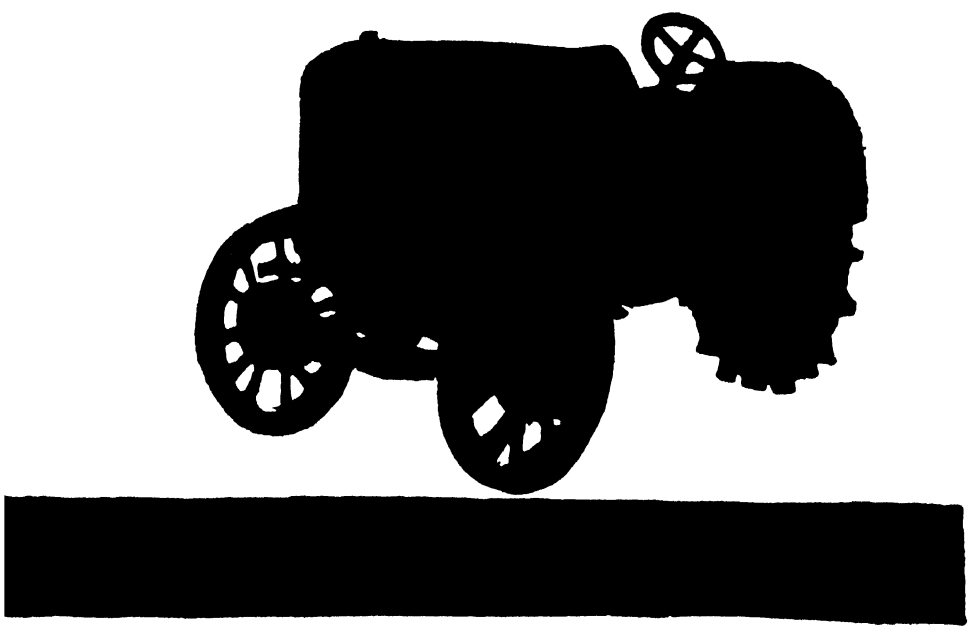
On the main street the tractor is assembled from these parts.

This is what happens. This main street is a continuously



moving track. A tractor comes along not a bit like a tractor. It has no wheels, no engine, no steering apparatus, no petrol tank, no radiator – nothing but a frame with axles. One worker builds in the petrol tank, another further on the engine, a third the radiator, and so on, until the tractor begins to look like a tractor.

At last the steering gear is added, and the chassis, but for the wheels, is complete. Then it enters a tunnel, and is painted. The painters' eyes are protected by goggles. They paint not with brushes but with a kind of gun, a spray which shoots the paint on to the chassis in the form of a mist, which settles more



evenly and dries more quickly than paint put on by a brush.

At last the tractor, painted and dried, is taken off from

ACCORDING TO THE FIVE YEAR PLAN THE PRODUCTION OF MACHINES WAS SUPPOSED TO INCREASE THREE-AND-A-HALF TIMES. NOW THE TASK HAS BEEN RAISED TO NINE TIMES

the conveyer and for the first time stands on its own legs, or we should say, on its own wheels.

Thus works the assembling department of a tractor factory.

There will be no mistakes.

A definite task is assigned each machine and a definite time for work: so many minutes, so many seconds. To each detail a definite time on the road, a definite schedule of arrival and departure. On the way between lathes a few extra details will always be attended to – for safety in case there is any delay. Before being placed on the tractor every motor is tested in an experimental station.

There will be no mistakes. Six minutes to the tractor, not seven and not eight, but just six.

IX. THE CHEMICAL BRIGADE OF OUR COUNTRY

1. Our Ally Chemistry

"While I looked on the massif of rock that the local population called 'The Giant' was blown up. We were about two hundred yards away when there came a series of dull groans from it, a shudder took possession of it, and it disappeared, wrapped in white clouds. Suddenly the white clouds too disappeared – and there was the cliff again, but wider now and lower."

Thus Gorky describes what he saw at Dnieprostroy. There rocks are shattered with charges of dynamite and soot. A small stick of dynamite, and a great rock is blown into bits.

Who invented this process?

The chemists.

Also, at Dnieprostroy, diver welders with lighted burners plunged to the bottom of the river, and, with a gas flame, cut steel under the water.

This the chemists invented too.

On the fields of any colfarm the earth yields twice as much grain as on the neighbouring peasant strips.

Why is this?

Because every colfarm fertilizes its fields with chemical products. Chemistry is a powerful ally of the colfarm.

With the help of chemistry we can break rocks, cut steel, make barren lands fertile. Chemistry cures, washes, feeds, clothes, and shoes us. Without chemistry we could not make leather, paper, soap, rubber, candles, medicines, dyes,

conserves. Without chemistry we could not bleach and dye cloth, refine crude petroleum, purify water for drinking, or wage effective war with the parasites which destroy harvests.

Chemistry transforms rubbish into useful and valuable things. From twigs and wood-shavings it makes silk; from pine stumps, turpentine and resin; from coal dust and

chips, petrol; from coal tar, dyes and medicines; from rushes and straw, cardboard and paper; from air and the escaping gases of coke ovens, ammonia, which is indispensable for the production of fertilizers.

Chemistry has taught us to make rubber without raw rubber, flower perfumes without flowers, leather without leather, wool without wool, stone without stone, bone without bone.

Buttons out of curds, silk cloth out of wood-shavings, oil out of coal – only recently such talk would have sounded like nonsense, like a fable. But all of it is now being done.

To those who know how to win her, chemistry is a powerful ally. In time of war she can fill the trenches of the enemy with poison gases. And she is able to create contrary gases to save people from these poisons.

The more of chemistry a country possesses, the richer and stronger it is.

Have we many chemical factories?

Very few.

2. The Chemical Brigade of the Country – Factories

Instead of deriving ammonia from coke gases we burn them in furnaces. Instead of making sulphuric acid from

the sulphuric gas generated in our copper blast furnaces we permit it to escape into the air and poison the surrounding country. Sulphuric acid we need badly for many forms of production. We have billions of tons of phosphorus, the very largest beds of calcium in the world, and yet our fields starve and the peasants do not even know what phosphorus and calcium are. We lack factories for making artificial silk, artificial wool, artificial leather. We have insufficient paper for books and newspapers. And in order to make all of these things we need no special kind of raw materials, but merely the wood which we have in great abundance.

This means that chemistry is the very weakest point on our front of construction. We need chemical factories.

Wherever we have coke ovens in mills for the smelting of iron, we must construct chemical sections – fertilizer factories.

Wherever we have forests, we must build factories for the making of paper, artificial silk, artificial wool, artificial leather.

In our plants for the refining of copper we must build factories for producing sulphuric acid.

Chemistry must conclude an alliance between metal and forest. To chemical factories the forest will give timber, brushwood, stumps, and the waste chips from lumber mills; while the metal industry will give gases from its ovens.

In electric power stations we shall pass steam through turbines and thus produce electric current. Then we shall take this steam, which though cooled is still hot, and send it on to the chemical factory to make paper, rubber, soap.

Our whole country will become a single huge factory, and in this factory the chemical section will occupy not the last, but one of the first places.

3. The War with Things

But the task of building all these chemical factories is not so easy. It is not enough that by 1933 we should increase the output of chemical apparatus twelve times. It is not enough to train thousands of chemists. Our greatest difficulty lies in the fact that almost all of these forms of production are new to us. Even the factories abroad which produce artificial fertilizers, artificial silk, and artificial leather have been established only in recent years. And there much is kept secret, much is guarded from us by foreign manufacturers. We must unlock these secrets, we must discover anew what has already been discovered. Perhaps you think that the production of ammonia from air and coal gases or the conversion of wood into silk is a simple matter!

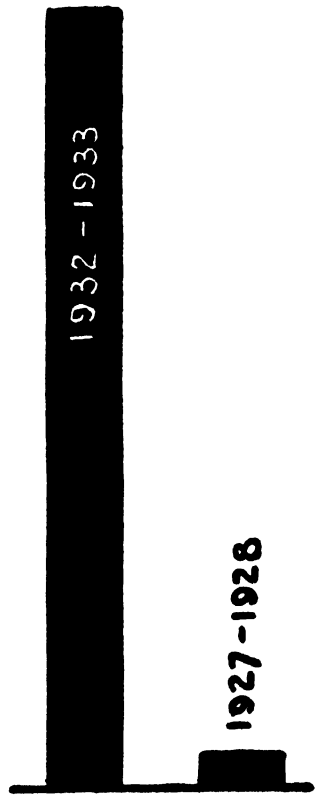
In the factories which produce ammonia, gases must be

cooled to 200 degrees below zero, heated to 500 or 600 degrees above zero, and held under pressure of hundreds of atmospheres.

At such high pressures gases begin to pass through the steel walls of the containing vessel as if they were made of cheese cloth. And the danger of an explosion! The red-hot gas eats into the steel and makes it extremely fragile. If the gas should break through its steel prison and escape, it would leave death in its wake.

The warfare with gas is difficult and dangerous. A special kind of steel is needed to hold it. Then a steel casing must be constructed around the entire oven in order that men may be protected against explosions. Everything must be anticipated and forestalled. Heretofore our engineers and workers have never had to deal with such terrifying cold (200 degrees below zero), with such cruel heat (600 degrees above zero), with such high pressure (up to 1000 atmospheres). Only since 1925 have we begun these new chemical factories; but already we have gained some experience. Already we have become accustomed to the machines and have learned how to deal with the dangerous enemy.

The war with things is not an easy one. It is frequently more difficult than the war with men. But in chemistry we have a powerful ally, she will help us.



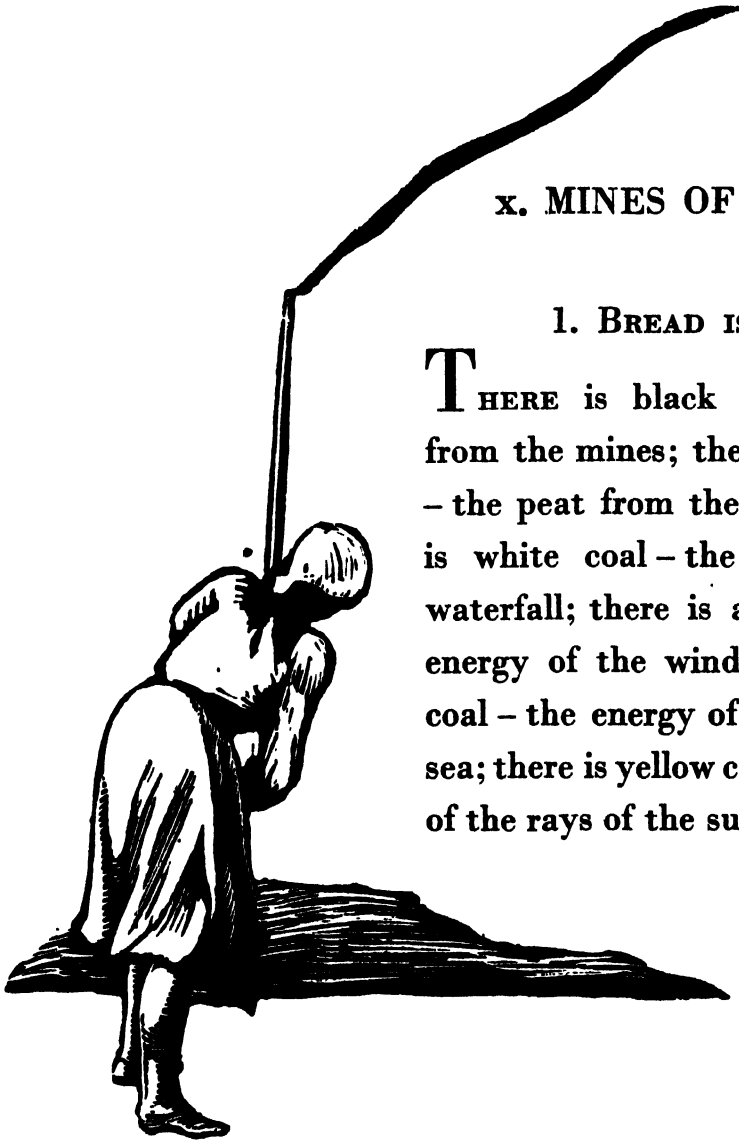
TRAINS TRANSPORT PHOSPHATES — FERTILIZERS — FOR THE FIELDS

IN 1927-28 OUR CHEMICAL FACTORIES GAVE US ONE HUNDRED AND FIFTY THOUSAND TONS OF PHOSPHATES. IN 1932-33 THEY WILL GIVE US THREE MILLION FOUR HUNDRED THOUSAND TONS

x. MINES OF GRAIN

1. Bread is Coal

There is black coal – the coal from the mines; there is green coal – the peat from the swamps; there is white coal – the energy of the waterfall; there is azure coal – the energy of the wind; there is blue coal – the energy of the tides of the sea; there is yellow coal – the energy of the rays of the sun.



THEY THRESH THE GRAIN WITH FLAILS. A STEAM THRESHING MACHINE WOULD DO THE SAME WORK IN ONE-TENTH THE TIME

And there is yet one more coal, one more source of energy – bread.

A piece of bread is not simply a piece of bread, but a

HERE WORK IS STILL DONE BY HAND AS IT WAS A THOUSAND YEARS AGO

charge of energy, several hours of concentrated labour of hands, feet, or brain. This coal we need no less than that which we burn in the furnaces of steam boilers. For we

must have power for men as well as for machines. We require millions of tons of bread, and not only bread, but also meat, milk, butter, vegetables.

And of this most valuable coal we have little. Scientists say that from our present cultivated lands we could harvest

twice as much grain as we do to-day. We produce much less bread than is necessary. At the same time many more people are raising grain in our country than are producing iron, coal, and other things.

Then what is the matter?

The matter is this. We produce coal and iron in large factories and mines with powerful machines, with well-organized labour.

Do we have many bread mines and grain factories? They have only begun to appear. And we still have very few of them.

More than half of our bread, meat, and milk is still produced in small peasant households, in small grain shops.

In the factories we have accurate nimble machines with tons of metal hands. On the farm you seldom see a machine. Here men work to-day as they did a thousand years ago, with hand tools – with sickle, scythe, flail, and shovel.

In the factories the workers have a clear, definite, and carefully formulated plan. On the farm the peasants work not according to a plan but according to habit, as their grandfathers did before them.

In the factories the workers know that in order to produce a certain number of tons of goods they need a certain number of tons of raw materials, a certain amount of heat, a certain number of hours of labour.

And does a peasant know, when he works, what the results of his labours will be? Does he know what harvest he will get? Whether he will have enough bread to last until the next year?

The peasant is in a constant state of fear; he has none of the assurance of the worker. A drought may burn up his sowings. A rain may rot his hay. An injurious insect may destroy his entire crop.

But this cannot go on. We must organize the labour of the people who produce bread. Would we tolerate the situation if our iron goods were produced, not in factories, but in a million village blacksmith shops, if we never knew whether we would have any iron goods at all, or whether we would have enough for our needs?

But how are we to convert all these little peasant shops into great factories? How are we to organize labour so that we need not fear rain, drought, or poor crops?

And can it be done?

2. Factories Without Walls and Without Roofs

In any metal works or chemical works the task is clear: with machines and out of raw materials steel, pig-iron, soap, soda, phosphates must be made.

If water is needed, the worker turns a tap and water

pours forth. If light is needed, he turns a switch and there is light. If electrical energy is needed, he makes a connection and there is energy. Cold of 200 degrees below zero, heat of 1000–2000 degrees above zero, pressure of a thousand atmospheres, rarification to one-thousandth of an atmosphere – all of this is at the complete disposal of the worker in the factory.

And in the peasant household? Here water is given not by water-pipes, but by a chance cloud in the sky. Light and energy are sent not by an electric station, but by the sun. However, can we command the sun to shine or not to shine? Can we command the rain to fall or to cease falling?

No, we cannot.

Does this mean that man is powerless in the face of nature?

No, here also we may carry on a warfare with nature.

We cannot extinguish the sun or stop a drought, but we can choose for planting the kind of grain that is least susceptible to drought.

We cannot force rain to fall, but we can dig irrigation dikes and send water through them into the fields.

We cannot make the wind cease blowing, but we can protect the fields from the wind by a wall of forest trees.

We cannot stop a deluge, but we can gather our crops so quickly that they will be in no danger of rotting.

We cannot grow grain on unfertile soil, but with mineral fertilizers we can make that soil productive.

We can force nature to obey. We can also organize labour so that all chance factors are eliminated, so that everything is estimated and weighed as in any chemical factory.

True, it will be more difficult here. A grain factory stands under the open sky, without walls and without roofs. Its shops are the fields. The very largest chemical factory you can cross in two or three hours, but a large grain factory, if it occupies 250–375,000 acres, you cannot cross in several days. And over this great distance must be moved men, and machines, and seeds, and fertilizers, and fuel, and the finished products – grain and straw.

And this is a most difficult task.

3. The Calculations of a Professor who did not Know how to Calculate

A certain professor actually composed a table in order to show how much time workers will have to consume in walking. He estimated that it is necessary for every worker to make six trips a day. In the morning from the headquarters to the place of work – one trip. [illegible]

headquarters to dine – a second trip. After dinner to the place of work again – a third trip. From the place of work to the headquarters to pass the night – a fourth trip. Also since, according to the professor, it may rain, we should assume one shower a day, and since the worker must get out of the rain, he will go to headquarters – a fifth trip. But after the rain he must go back to work – the sixth trip.

If the headquarters is near the place of work, the situation is not so bad. But if it is distant three or four miles, then the worker will spend seven hours a day in walking. And only one hour will remain for labour.

If the place of work is not five but six miles distant, every worker will spend the entire day in walking.

And if the distance should be more than six miles, the worker will never reach the place of work. It will be as inaccessible to him as the North Pole or Mount Everest.

And in truth, the worker will barely make half the distance before he must run home to dine. He finishes his dinner and again runs half-way, but is forced back because it starts to pour with rain.

And from this series of intricate calculations the professor draws the following conclusion: large grain factories should not be organized.

But is it not possible to transport workers by train or in buses?

No, this also cannot be done. For five or six thousand persons to drive through a factory six times a day is no joke.

It would cost too much.

Is the professor then really correct? Is a large grain factory really an impossible thing?

No, the professor is mistaken. We already have large grain factories, and they work well. The huge grain factory, Gigant, has been running since 1928. Do you know how large it is? Forty-five miles from north to south, twenty-five miles from east to west.

What happens then? Do the workers go about on foot there?

No.

Do they ride in buses?

No.

They live where they work.

And this is very simple. One need not be a professor to think of it. Any schoolchild in the first grade will tell you that workers need not run to headquarters to dine when it is possible to take along a kitchen on wheels and dine in the field. Also they need not return to headquarters to sleep. They can pass the night in a tent. But suppose it should begin to rain. What a calamity! Do men actually run from rain to headquarters several miles away? A tent

will protect them. Red soldiers live all the summer in tents.

Matters can be arranged so that men do not have to run a whole day. And this is not so difficult.

4. Factories on Wheels

And how about the machines? In ordinary factories machines stand firmly in place, screwed to the floor or the foundation. But in a grain factory machines cannot stand, they must be moved from place to place.

And how is this arranged?

By putting machines on wheels.

An agricultural machine can be distinguished at one glance from any factory machine. It has wheels.

Visit Gigant. There you will see workers' houses on wheels, shops on wheels, reservoirs on wheels, post-offices on wheels, print shops on wheels.

The motor in the grain factory must also be on wheels. It must not only drive machines, but it must also move them about.

Such a motor is the tractor.

At Gigant workers and machines wander for a whole summer through the grain factory. Who would have thought a few years ago that it was possible to have a

THE HARVESTER IS TOWED BY A TRACTOR

wandering agriculture, just as there are yet here and there wandering cattle breeders.

But how are connections maintained? In a factory the operations must be closely linked up. The foreman must know what each worker in his shop does, and the superintendent must know what each shop in his factory does.

And here in the grain factory one brigade of workers is separated from another by dozens of miles. You could not even see them all with a telescope. But the necessary connections can be established by telephone. At Gigant telephone wires are stretched through all the fields. Any brigade can speak at any moment with the central office – with the chief of staff of the grain factory.

5. When One Man Replaces a Hundred

But in a large factory large machines are needed. Are there such machines?

There are. Gone is the time when the sickle and the scythe were the only tools for reaping. Now a single machine will do the work of hundreds of sickles and scythes. The reaper of to-day is a mechanic in overalls and goggles, with brown gloves on his hands as a protection against oil and dirt. He stands on a little bridge belonging to his

machine – a harvester – high above the ground. In his hands is a whistle. With this whistle he gives orders to the driver.

The harvester moves through the field.

A huge revolving fender presses the stalks against the knives. Rapidly the knives move backward and forward and cut the straw. The fallen stalks then run by themselves into the machine where they are met by a thresher and a winnowing apparatus. In the twinkling of an eye the head is separated from the stalk and the grain is threshed, winnowed, and passed into a tank which is suspended above the operator's head.

The machine does three things at one time: it reaps, it threshes, and it winnows.

The harvesters go through the field – like a squadron – in a curved line: the first leading the way, the second is behind and a little to the left, the third is still farther back and more to the left. Proceeding in this fashion they do not interfere with one another. Each machine cuts a strip sixteen feet wide. Ahead is a limitless sea of wheat stretching for tens of miles. In order to reap all this with the scythe, to bind it into sheaves, to thresh it with the flail, to winnow it with the shovel, thousands of men would be required. And here several mechanics in blue overalls do the entire job. One man with a harvester is equivalent to one hundred men using hand implements.

And the work of this one man is, of course, lighter.

"You are so worn out," hand-reapers say, "from wielding the scythe during the day that you cannot rest at night. When you sleep your hands go on twitching as if you were still mowing."

The operator of a harvester does not have to swing a scythe; he stands quietly at his post and looks on. The machine mows of itself.

6. A Living or an Iron Engine?

The grain factory has the tractor.

And what kind of engine does the peasant have?

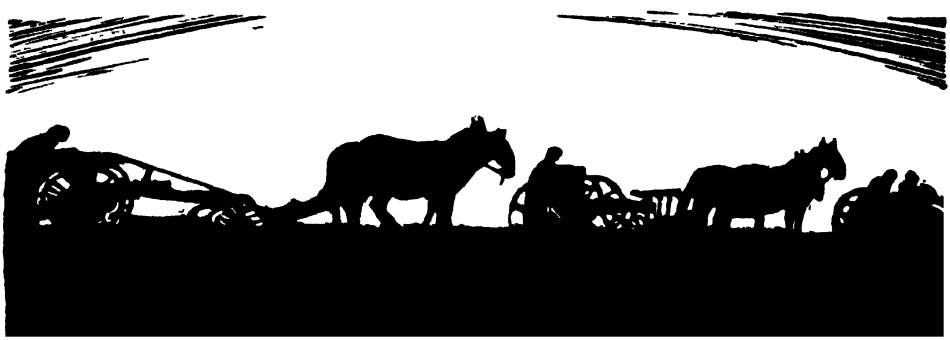
The horse.

The horse is the most greedy, the most gluttonous of all engines. It devours one-half of all that the peasant pro-

duces on his farm. In the steppe region of the Ukraine the peasant spends fifty pounds a year on his horse – as much as he spends on his whole family.

A horse is a voracious engine and at the same time a very weak engine. One tractor can do the work of twenty and more horses. And with a horse you cannot plough the earth as deep as you can with a tractor.

But even this weak engine is too strong for the peasant's farm. The ordinary horse works much less for the peasant than it might. Think of all the days a horse stands idle. Only about a hundred days a year does it labour. And yet it has to be fed all the time. It is not like a tractor which uses petrol only when it works. And even when the horse works, it does altogether too little, because on a peasant's farm there is not enough to do to keep one horse busy. And why? Because the farm is too small. One-half of a horse



would suffice to cultivate the tuft of earth that the poor peasant owns. His horse could do a great deal more if he had more land and more horse-drawn machines: a rake, a plough, a planter, a reaper, a thresher. He could then force the horse to do what he must do himself now: plant, reap, and thresh. But there is precisely where the trouble lies: every peasant does not have machines.

The only way out is for the peasants to unite, to organize guilds and cultivate the soil collectively, with all horses and all machines owned collectively. Fewer horses would then be needed, and every horse would have more work to do. A collective farm can do many things: it can buy machines and mineral fertilizers. A large collective farm need not use horses at all, but can replace them with tractors.

7. M.T.S.

M.T.S. means Machine Tractor Stations. They are being organized in order to help the village make the transition from hand to machine work, from individual to collective farming.

The first M.T.S. was organized in 1928 in the govfarm of the name of Shevchenko. There the M.T.S. entered into a contract with twenty-six villages. This agreement was as

A DETACHMENT OF TRACTORS STARTS OUT TO WORK. EACH TRACTOR TOWS NOT ONE BUT SEVERAL HARROWS. THE HARROWS HAVE DISKS INSTEAD OF TEETH. THE DISKS HAVE SHARP EDGES

follows: the peasants were to unite all their fields and remove all dividing fences and barriers, and the station was to place at their disposal a detachment of tractors and an accompanying staff of agronomists and mechanics.

The results for the year were as follows:

The cost of the cultivation of the soil decreased from twenty roubles to fourteen roubles per *hectare*, and the income increased from fifty-two roubles to eighty-three roubles per *hectare*. Needless to say, the peasants did not regret having entered into the contract. Now we have many such stations. Hundreds of villages are being led by the M.T.S. toward mechanized and socialized agriculture.

8. Two Departments of a Grain Factory

Govfarms and colfarms are more profitable than the individual peasant farm. For one thing, the harvest is much higher. On the Shevchenko govfarm the yield of winter wheat per *hectare* is one and a half tons, while on the neighbouring peasant strips it is only three-quarters of a ton.

On the Colfarm Kolos 2 (in the Leningrad region) the harvest of hay and barley was one and two-thirds tons per *hectare*, and on the land right next to it the yield was only one ton. In the case of potatoes this colfarm produced

twenty tons per *hectare*, whereas the peasant farms only produced eleven tons.

These examples I have taken at random. I did not select them.

But a grain factory also produces straw. What is to be done with it?

Should we throw it away? This would mean that we would throw away three-quarters of the goods turned out by the factory. Whoever heard of such a thing – a factory having three tons of waste for every ton of goods?

This cannot be tolerated. A good factory should have no waste, no trash.

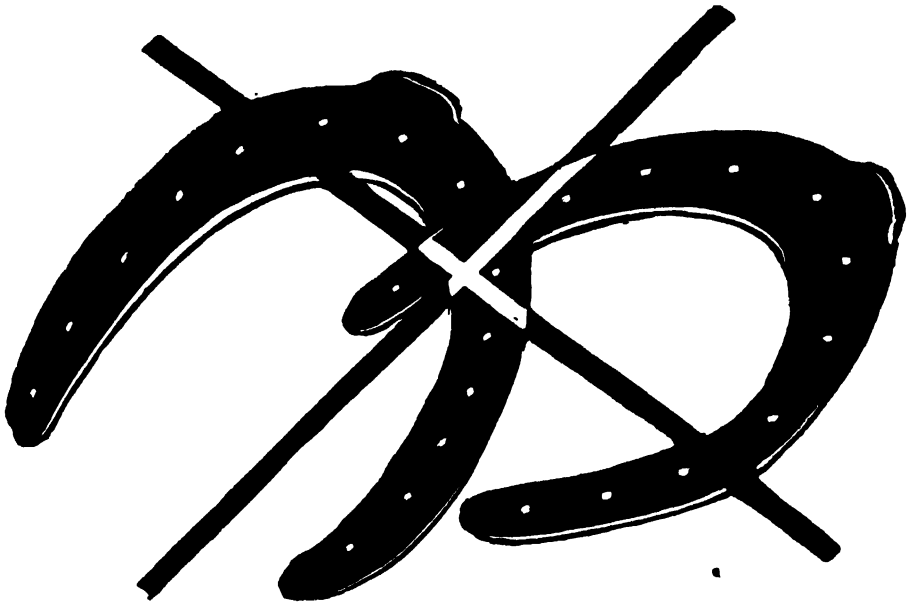
Straw should not be thrown away. It can be transformed into meat and milk.

But in order to do this we must organize, in addition to the grain department, one more department – a dairy section.

In a grain factory, as in any other factory, everything must be used. The waste from one department – straw – should go to another, and be turned into meat and milk. The waste from the second department – manure – should go back to the first and fertilize the fields.

Nothing should be wasted. One department should support the other.

Such is the case on govfarms and colfarms. But on



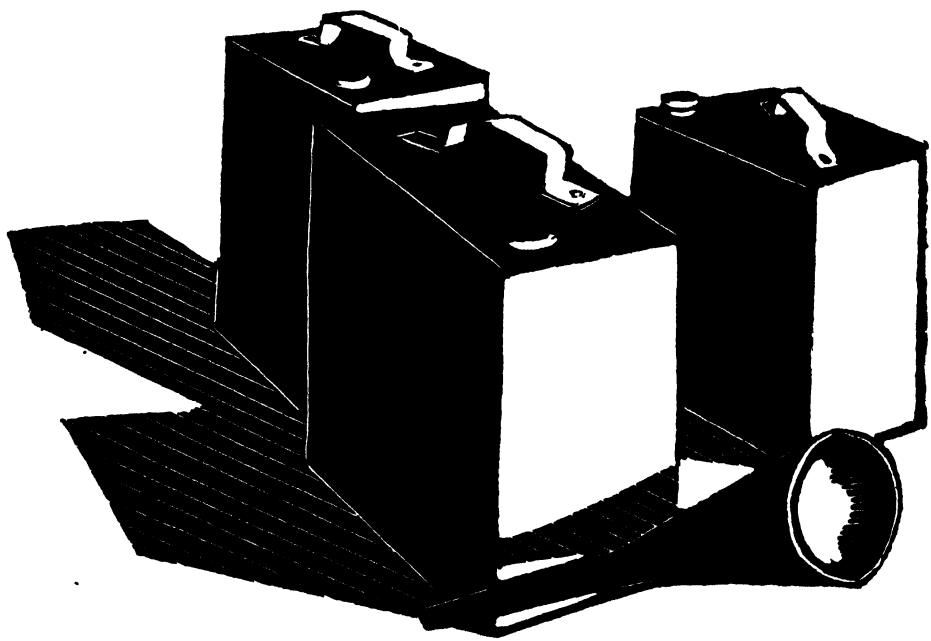
individual farms the situation is just the reverse. There, cattle die off because of insufficient grain and straw. And the grain is inadequate because of the lack of manure. The horse fights with the cow and takes away its fodder. The horse must be fed. Otherwise there will be nothing with which to plough the soil, nothing with which to feed the cow, nothing for the people to eat.

This seems like an enchanted circle from which there is no possible escape. Yet there is a way of escape – through the colfarm.

On the colfarm the cultivation of the soil is superior: the yield of grain and straw is greater. On the colfarm the cow

gets better food and gives more milk. On the colfarm fewer horses are required to cultivate a given area; hence more cows can be kept. And if tractors replace horses on a colfarm, so much the better. A tractor does not deprive a cow of its fodder.

No matter from what side you approach the question the conclusion is clear: a change is necessary. And this change is already going on. It has embraced one-half of all the peasant farms and in a few years, in place of millions of poverty-stricken individual households, we shall have one mighty union of grain factories.



9. We Shall Change the Map of the U.S.S.R.

Bread is the most valuable, the most useful coal.

And we shall have this coal in abundance, if we only organize our labour wisely. Natural resources of coal or peat we cannot increase, but the reserves of bread we can double, triple, raise ten-fold.

We can irrigate deserts, dry swamps, plough steppes, and force even the sands to give bread.

In Central Asia, in Kazakstan, in the regions beyond the Caucasus, we shall lead canals across deserts and steppes, we shall create hundreds of oases, we shall plant rice and cotton. The Hungry Steppe of Kazakstan shall cease to be hungry and unfruitful. We shall transform it into a flowering plain.

In White Russia and in many other places we shall dry swamps and convert them into prairies.

In the Northern Caucasus, in Kazakstan, we shall plough steppes and force wild grasses, docks and thistles, to step aside and give way to wheat.

We shall take possession of vast empty spaces in the south and in the east and shall transform them into green pastures and cultivated lands. During the five years we must conquer seven million acres of new territory. Such an area is equivalent to two Esthonias or two-and-a-half Lithuanias.

In certain regions, where to-day forests grow, the soil is

black and fertile and capable of giving us the richest of harvests. We shall cut down these forests and seed the land to grain. Then we shall plant trees on sandy and unprofitable soil.

With forests we shall subdue the sands and reinforce the banks of ravines. With forest walls we shall protect railway tracks from drifting snow. With forests we shall shelter fields from the hot winds of the south.

10. A Colossal Task

To create oases in deserts, to transfer forests from one place to another, to convert swamps into fields – such are the great tasks which the Five Year Plan sets before us.

But still more difficult, still greater, is yet another task: to change the life of millions of people, to pull poverty, and darkness, and slavery out by the roots.

We need colfarms and govfarms not merely to produce bread.

And we need machines not only that work may go on more rapidly and more efficiently.

We know that the machine is capable of being either a friend or an enemy of man.

The same harvester and the same tractor that deliver our

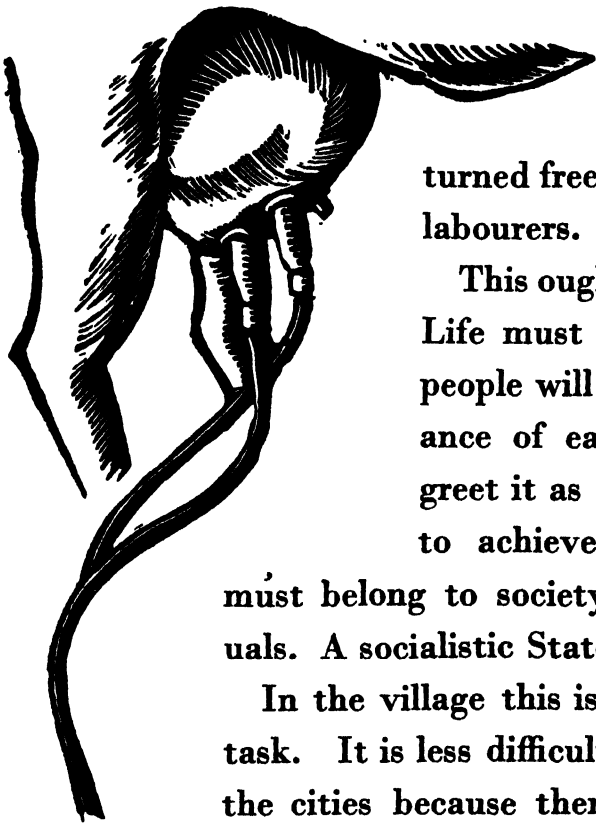
V. R. NARLA

peasant from poverty and drudgery in America have caused millions of people to leave their homes and wander through the land. Every new machine invented is a curse for many workers.

In America also small farms consolidate to form large agricultural factories. But how does this occur there? A machine is invented. Every small farmer must buy it, or he will be at a great disadvantage. But he has no money with which to make the purchase. He therefore becomes entangled in debts, is forced to sell out to some banker or merchant, and ends his life as a worker on the very farm which at one time belonged to his father or grandfather. But in time another machine is invented, better than the first. Half of the workers are discharged. Often a person who was born and raised on a particular farm is forced to leave and join the ranks of the unemployed. The machine has thrown the man out of his own home and taken both bread and shelter from him and his family.

An American writer says:

"Since the invention of agricultural machines a whole army of wandering farm-labourers has appeared. Frequently they cover tremendous distances in order to find work during harvest time. Since they have no money, they steal rides on freight trains or travel by foot. They are a completely disheartened people."



That is what machinery has done in America. It has turned free men into slaves, farm labourers.

This ought not to be permitted. Life must be so organized that people will rejoice at the appearance of each new machine and greet it as a friend. But in order to achieve this goal machines must belong to society and not to individuals. A socialistic State must be built.

In the village this is by no means an easy task. It is less difficult to build socialism in the cities because there the State owns all machines and all factories. The State can conduct the work in the interests of the whole society, of the entire country. In the village there are many owners. Each peasant owns his tools, his horse, his cow. Each peasant works in his own way and works badly, because he must work on his miniature farm, in his little hand shop. The country consequently suffers from a scarcity of foodstuffs and raw products for its factories.

But this is not all. In the cities the workers have broken

the power of manufacturers; they have driven out the great landowners; factories and mills now belong to the State. In the village we still have private property, we still have individual ownership. And the capitalists of the village, the kulaks, the peasants who have made money, are of course opposed to all forms of collectivism. They pull backwards and strive to hamper the peasants who desire to unite and build up a socialized farm. This is the chief obstacle in the way to socialism.

In the socialistic State there will be no classes. The Revolution first removed the manufacturers and landowners. Now we are setting ourselves the task of disarming another class – the kulaks, the capitalists of the village.

XI. THE WAR WITH THE MILES

1. Rivers of Freight

During five years we shall build thousands of new factories. And each factory will turn out thousands of tons of freight. Over a network of railways and water-ways this freight will flow in all directions. Throughout the whole country rivers of freight will flow, rivers of coal, bread, lumber, iron, cotton, machines.

Whence will they come and whither will they go? This we can foretell. Because here, as in the whole of nature, laws govern.

Rivers of water flow into the seas.

Rivers of freight flow into large cities, into manufacturing centres.

Where do we have the largest number of factories?

In Leningrad and Moscow.

So it is into these cities that two of the largest torrents will flow. One from the south, along the meridian, from the Donbas, and from the Ukraine. Another from the east, along the parallel, from the Urals and Siberia. A third wide river of freight will flow from the Donbas west and bring

coal to the Krivorozhsky factories. A fourth will carry bread and lumber from Siberia into Turkestan. A fifth will transport Kuznetz coal from the Altai Mountains to the Urals.

Hundreds of rivers of freight will flood the entire country like waters in springtime.

But water cuts its own channel, builds its own way. Coal, cotton, iron, and lumber, of course, cannot construct roads themselves. We must do this for them. We must prepare the country for the great freight flood: we must dig canals in one place, lay a railway in another, build a port in a third, and reinforce bridges, rails, and ties everywhere.

If we fail to do these things the whole Five Year Plan will collapse. Because by 1933 we shall have to transport twice as much freight as we are transporting now. Every factory that we build is not only a factory but a railway station too.

Examine the plan of any large factory. You will see signals, points, goods waggons, depots, hydrants, cabins for watchmen. As the railway approaches the factory it splits into tens of branches so that it may reach every building and bring raw material and fuel to every department. A coal or pig-iron depot is at the same time a railway station. With the noise of thunder trains fly into the very heart of the building. Smoke from locomotives rises to the glass roof, shutting out the light. Everywhere in the

works you hear whistles, see long chains of red trucks. How can you draw a line between railway and factory?

Stop the flow of goods and the works also will stop: they will die.

We must prepare roads beforehand. If we fail to do so, dams will be flung across the rivers of freight, one after another the streams of traffic will cease to flow, stagnant lakes will form at the crossing stations and overflow warehouses and waggons.

We must not let this happen.

But what can we do to make railways transport twice as much freight as they are transporting now?

We must compel the trains to run more swiftly and we must use every locomotive to its full capacity.

We must organize the work so that not one locomotive, not one coach, will stand idle. Men require rest, but machines never tire. The question of repairs is, of course, a different matter, but repairs can be made more quickly so that locomotives will not have to remain in the shops a single extra day.

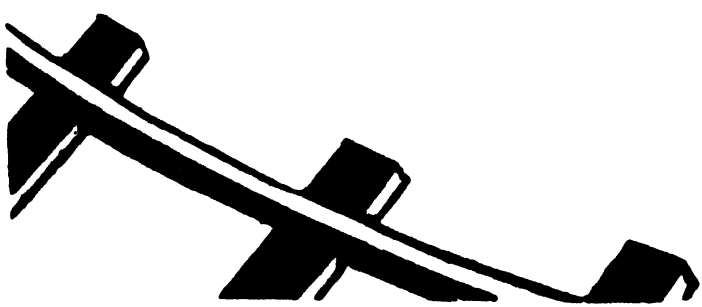
But this, too, is not all. In order to meet all our transport needs we shall have to build thousands of miles of new roads, thousands of new coaches and locomotives. Our whole network of railways must be reorganized and regenerated according to one general plan.

2. What is a Railway?

One large factory is better than several small factories.

Likewise one large railway is better than several small railways.

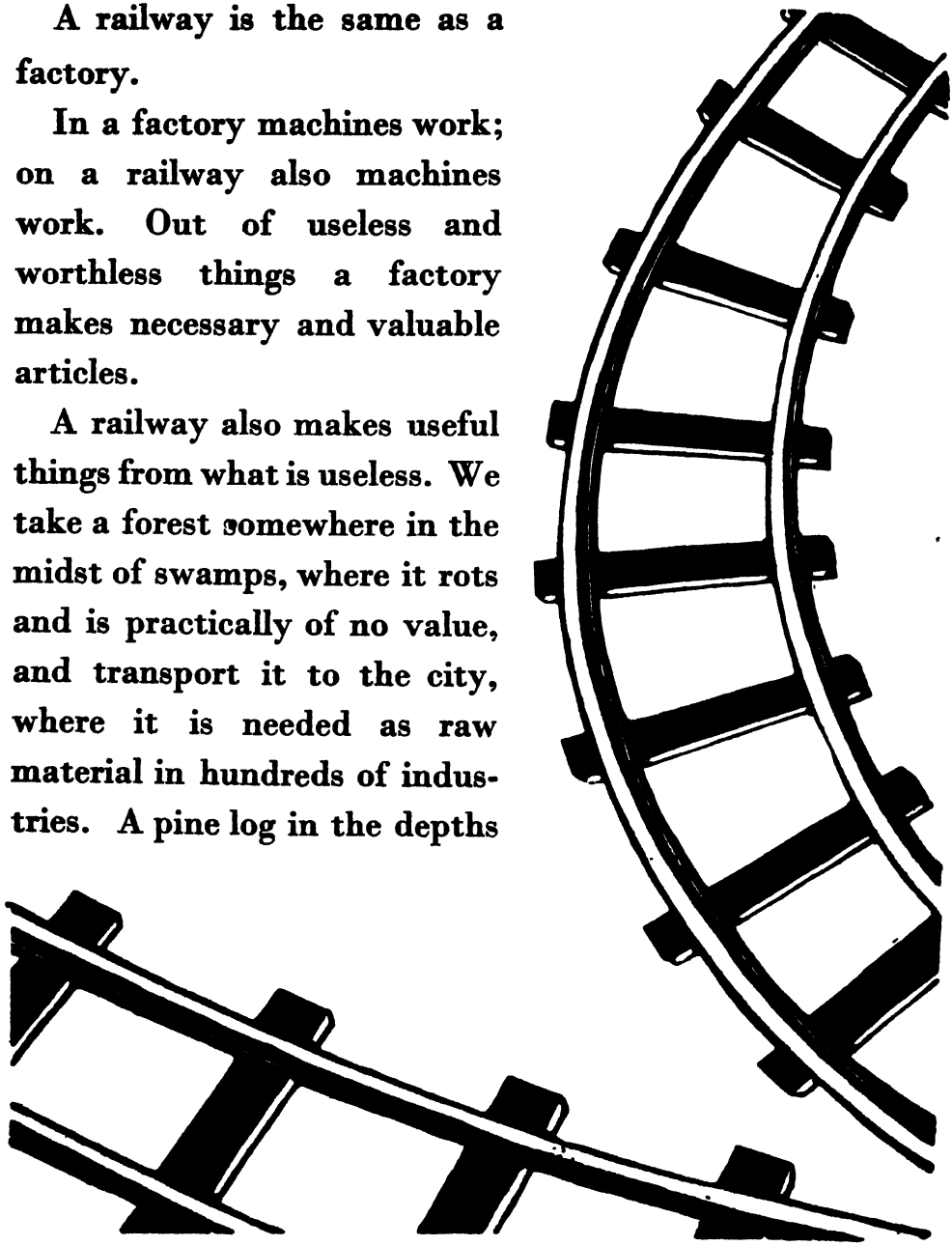
After all, what is a railway anyway?



A railway is the same as a factory.

In a factory machines work; on a railway also machines work. Out of useless and worthless things a factory makes necessary and valuable articles.

A railway also makes useful things from what is useless. We take a forest somewhere in the midst of swamps, where it rots and is practically of no value, and transport it to the city, where it is needed as raw material in hundreds of industries. A pine log in the depths



of a forest and the same pine log at the gate of a saw-mill are two very different things.

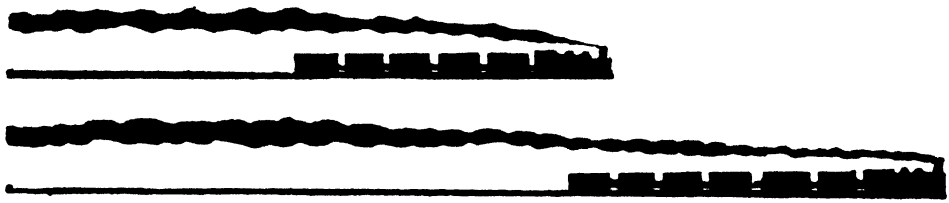
A railway is a factory. And the larger this factory the better it will work.

In all of our factories we try to install the strongest machines, the most powerful engines, because they are most economical. In proportion to their strength they use less fuel and work more efficiently than their weaker rivals.

On a railway we have precisely the same situation: we must have the mightiest of locomotives. No longer shall we build the feeble engines of the past. We shall construct freight engines of the powerful new Series E – with ten revolving wheels.

In the factory the number of steam engines grows less and less, being replaced by electric motors. On our railways also we shall change to electric power. Near the Kashir station we shall build an electric railway from Tovarkovo to Ozherelie. In the Caucasus, in the region of the Zages and Rionges electric power stations, electric trains will run between Tiflis and Kashuri. From Moscow and Leningrad electric trains will link up the various suburbs.

Already we have electric trains from Baku to the Sabunchinsky and Surakhansky oil wells; also from Moscow to Mitishchi.



IN 1927-28 WE HAD 48,000 MILES OF RAILWAYS. BUT BY 1932-33 WE SHALL HAVE EXTENDED THE RAILWAY NETWORK TO 60,000 MILES

In time we shall electrify all of our railways.

For after all, the electric locomotive is the most profitable. A steam engine has to produce its own energy. But an electric motor obtains its energy from the electric power plant. A locomotive has to carry quantities of coal and water, and a steam boiler besides. An electric motor carries nothing. To burn coal or to generate steam is the business of the electric power plant.

Also, the electric motor can pull a larger number of coaches and develop a higher rate of speed than the steam-engine; and moves with fewer jerks and is thus less wearing on the track.

But if all these things are so, why should we not electrify all our tracks?

Because the matter is not so simple. To accomplish this we must cover the whole country with a network of wires and electrify the entire union. Such a task you cannot perform in five years. But from the first

small experiments we shall pass on to larger achievements, and perhaps, during the next five year period, coal from the Donbas will be delivered in Moscow by means of electricity.

Electric traction, however, is not everything. There are many other improvements to be introduced to increase the speed of our trains.

In factories we already have automatic machines, and on railways such machines can also do the work of men. Automatic couplers and signals are now in use. Machines have likewise been invented for the loading and unloading of trucks, for the repairing of the permanent way, for the supply of coal to the locomotive.

The railway is a factory. But if it is to work as well as other factories many changes must be made.

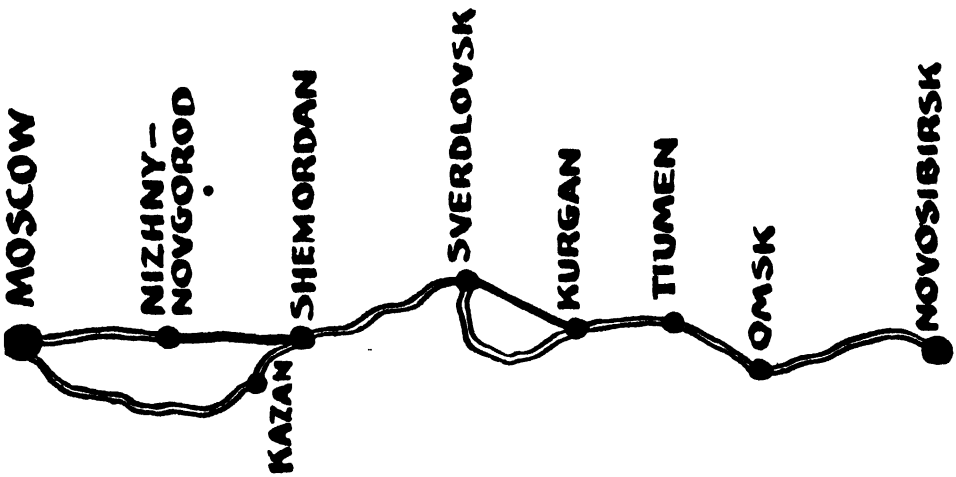
3. A Giant Road

Already we have giant factories; and we shall also construct giant roads, to carry the largest rivers of freight.

The most powerful of such rivers will flow from Siberia to Moscow. The way is long. Day after day the level steppes flash by the windows of the train. Gradually the hills grow larger; the earth rising gently, falling gently

away to the horizon. Hills expand and turn into mountains. Dark forests shut out the light only to give place again to the open steppe. Ridge, plain, and woodland follow one another in eternal succession. It seems that the white mile posts will flash by for ever.

And along this endless road will go millions of tons of grain, of lumber, of metal. Rapidly the miles will fly. Each



MOSCOW TO NOVOSIBIRSK

THE DOUBLE LINE IS THE OLD WAY. THE SOLID LINES INDICATE THE SHORTER ROUTES

mile a penny. The transport of one ton of goods over one mile will cost only one penny. But when millions of tons go, it will mean millions of pennies. And when millions of tons go thousands of miles, then it will mean thousands of millions – billions of pennies. A billion pennies are over

four thousand million pounds. Thus to transport freight from Siberia to Moscow will cost us millions of pounds.

If we could only bring Siberia nearer to Moscow! How much money we then would save! And money means labour – our own labour.

But is it really possible to bring two regions nearer which are separated by thousands of miles?

4. How to Bring Siberia Nearer to Moscow

Look at the map. Follow the track all the way from Moscow to Novosibirsk. In many places the track curves and makes unnecessary turns. Why did they build it so? Who can tell now! In former times, before the Revolution, railways were constructed without a definite general plan. Each city sought to draw the track to itself. The track consequently twisted and wriggled, depending on which could pull hardest. Now the railways must be straightened, the mistakes made by others corrected.

See what a tremendous circle the Siberian railway makes between Sverdlovsk and Kurgan. Why does it go into Cheliabinsk, when this city is altogether out of the way? From Sverdlovsk to Kurgan a new direct road must be built.

Between Moscow and Kazan the track again makes a

A WOOL TRAIN

great curve. Let us now take another railway, not to Kazan, but to Nizhny Novgorod. And from Nizhny we will build a new section of the railway directly to the station of Shemordan.

This alone has shortened the line by many miles.

But this is not all. Siberia can be brought still nearer. The railway can be reconstructed so that there will be no sharp gradients anywhere. The sharper the gradient, the more difficult for the engine to draw the train; and the heavier the load the greater the consumption of coal. But coal costs money.

If we moderate the gradients, if we take out the curves, we shall transform the Siberian railway into a giant line.

Over this new line trains will run more rapidly than over any of the other lines. And every mile will cost not a farthing per ton, but only half a farthing.

Is this not the same as halving the distance between Moscow and Siberia?

5. New Railways

But to rebuild old lines is not enough. We must construct a large number of new ones.

In many regions our railways are inadequate. Consequently forests decay; and deposits of ore, coal and fertilizers lie unused in the earth. In Turkestan only one-fourth of the irrigated land is planted with cotton. And we need cotton so badly for our Leningrad, Moscow, and Ivanovo-

Voznesensk factories that we import it from America and Egypt and spend millions of pounds for it every year. Why then do we not grow cotton everywhere in Turkestan? Because we are forced to raise large quantities of grain there. If we could secure grain from some other region, Turkestan could turn to its natural occupation and concentrate on the raising of cotton. There is an abundance of grain just across the way in Siberia. But heretofore it has not been available to Turkestan because there is no railway connecting the two regions.

This shows what a railway can mean to the world. The absence of a line here is felt in Siberia, and in Turkestan, and in Moscow, and in America, and in Egypt.

However, the needed road has just been constructed. Only three years ago air pilots with cameras flew over the summits of the Chokparsky Pass, photographed the sea of rock below, and discovered a way for the future railway. In order to link Siberia and Turkestan nine hundred miles of track had to be laid. Work began at the same time from both ends. Winding through steppes and deserts, crawling over mountain ridges, two halves of a single railway reached out the one to the other. And on the 28th of April 1930, seventeen months ahead of the scheduled date, they were joined up in one great Turkestan-Siberian Railway.

This is but one of our new railways. We need others. We must join Magnetic Mountain with Kuzbas by railway. Otherwise Kuznetzky coal and Magnetic ore will be unable to meet and produce iron for our machines.

We must take railways into the dense northern forests and open up the riches of the north and Siberia. We must find an outlet for the grain from the region beyond the Volga and for the meat from Kazakstan. And how about the phosphate deposits near Viatka! If we do not go to them, they assuredly will not come to us; our govfarms and colfarms will be left without fertilizers.

Eleven thousand two hundred and fifty miles – this is the total length of the new railways that we need. Each new railway is an iron key which opens the locked doors of nature.

6. Ways Without Rails

According to the Five Year Plan, we must construct 3385 new locomotives and 165,000 new coaches. But, if we have no motor cars these locomotives and coaches will remain idle. We cannot build a railway for every colfarm, for every village, for every co-operative. A railway is a large river; but a large river cannot exist

unless hundreds of little rivers, streams, and brooks flow into it.

We need not only engines, but also motor vehicles; not only railways, but also ways without rails.

We have 1,900,000 miles of ways without rails. This multiplied by only eight is the distance from the earth to the moon.

But how sad is the condition of these ways! Of good roads, paved, macadamized, and others, we have only 6250 miles. The rest are good for nothing. Ruts, holes, pits, crazy bridges. Along such roads even a light peasant cart cannot always go, much less a motor car.

And in just one factory in Nizhny Novgorod we expect to build two hundred thousand motor cars a year. Into the Siberian swamps, the Kirgiz steppe, everywhere the motor car will penetrate. But for this roads are needed. A motor car without a road is like a train without a railway. Abroad, motor roads are veritable streets, paved with asphalt and cement, streets through the expanse of well-kept fields. Such roads we also have begun to build in the Crimea, in Transcaucasia, and in the North Caucasus.

To dress 1,900,000 miles of road in asphalt and cement in five years is, of course, impossible. The Five Year Plan calls for the building of 22,500 miles of improved roads: macadam, asphalt, and others. But, in addition, every city and every

village must with its own strength repair and keep its own roads in order. Because of bad roads and costly transportation every man, woman, and child loses several pounds sterling a year. This fact must never be forgotten.

7. How About the Aeroplane?

The motor and the train on the ground, the aeroplane in the air.

By 1932 we shall have 138 air-lines and 70,000 miles of airways. This is six times as much as we have at present. It will then be possible to fly from Moscow to Vladivostok and Tashkent, from Novosibirsk to Berlin. Tens of air-lines will go over the forests of Siberia, over the mountains of the Caucasus. In 1932 12,000 passengers, 3500 tons of mail, and 2500 tons of freight will be transported by air.

But the aeroplane will not be engaged in transport only. It is not merely a carrier and postman; it is also a huntsman, a photographer, an agronomist.

Aeroplanes will serve the fur industry in Siberia by discovering seal rookeries set as black spots against the white snow. They will destroy injurious parasites by spraying crops and forests with chemicals. They will aid in the constructing of railways by photographing the earth from above.

8. A New River

We shall build thousands of miles of railways and ways without rails. But already nature has provided us with these ways in the shape of rivers. These ways, however, do not always go where they should. The Volga can do the work of six railways running side by side. But these six paths lead nowhere – but into the Caspian Sea.

And the Caspian Sea is really not a sea at all, but a lake. It has no outlets. We cannot therefore export grain and lumber abroad by way of the Volga, because the Caspian Sea stands alone.

Also we cannot transport Don coal to factories along the Volga, because there is no passage from the Don into the Volga.

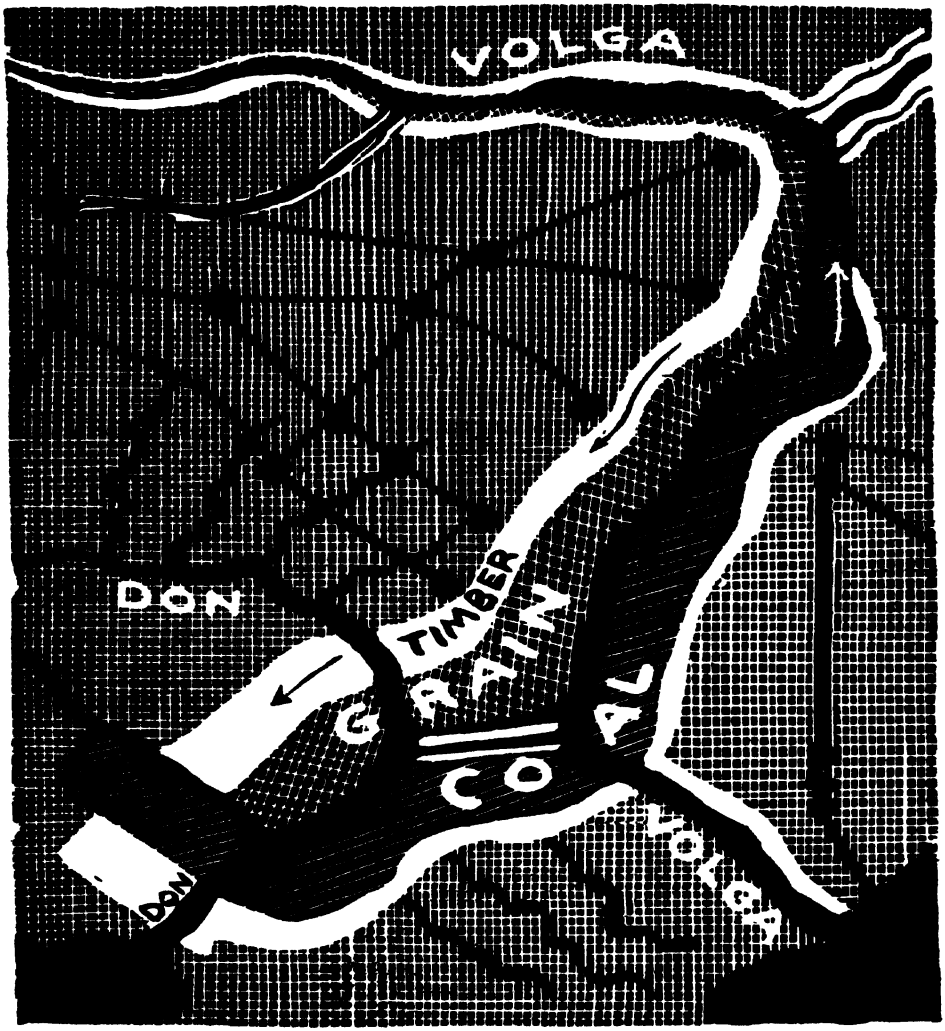
Nature has given us an excellent free highway, but this highway leads nowhere.

Perhaps we can change it.

In all of our work we are constantly changing nature. The irrigation of deserts, the shattering of cliffs, the transportation of lumber from place to place – is this not the changing of nature?

The Volga flows nowhere, into the Caspian Sea. We shall force it to flow into the Black Sea. We shall unite the Volga and the Don by a canal.

M-MGR



LUMBER AND GRAIN WILL GO SOUTH — TO THE BLACK SEA. COAL WILL GO NORTH — TO THE FACTORIES OF THE VOLGA. A TORRENT OF COAL, WIDE AT FIRST, BECOMES NARROWER AND NARROWER AS THE FACTORIES TAKE THE COAL ALONG THE WAY. ON THE OTHER HAND, TORRENTS OF GRAIN AND LUMBER BECOME WIDER AND WIDER; THE LUMBER COMING FROM THE SAW-MILLS, THE GRAIN FROM COLFARMS AND GOVFARMS

This is a huge undertaking. It will require the construction of a canal over sixty miles long and over two hundred feet wide. At the outlets to the Volga and the Don two giant sluices will be built. On the side of the Don, there will be four locks; on the side of the Volga, nine. In order that the canal may not fill up with silt, a powerful pumping station will be constructed near the Don to force water into the canal by a pipe a mile and a quarter in length. The diameter of this pipe will be such that the tallest man can stand erect inside without bending his head.

Not so long ago boatmen hauled ships up the Volga. A gang of men trudged along the bank, and with shouts and songs, bathed in their own sweat, dragged the heavy barge. On the new Volga-Don river this work will be done by iron boatmen – tractors. And in time electric wires will be stretched beside the river and ships will be towed by electric engines.

9. Spring Waters Imprisoned

Within a few years all the maps of the U.S.S.R. will have to be revised. In one place there will be a new river – the Volga-Don; in another – a new lake.

As yet this new lake has no name. It will unite two rivers – the Kama and the Pechora. Where the waters of the lake

will soon shimmer, is now a vast swamp. Every spring, when the snows melt, the waters race down the Pechora and the Kama. We shall make these waters prisoner. We shall build two high dams and impound the melting snows; we shall not let them escape. Behind the dams a lake seventy miles long will appear.

Over the surface of this lake, ships will go to the Volga laden with lumber from the Pechora region. The Volga will then be joined not only with the Black Sea, but also with the Arctic Ocean. That is the first thing the Kama-Pechorsky lake will give us.

But this is not all. The overflow from the lake will go into the Kama. And there we shall construct an electric power station.

And this also is not all. The Kama-Pechorsky lake will raise the level of water on the Kama, and great ships will go up the Kama as far as Solikamsk. But do you know what Solikamsk means to the Soviet Union? Near Solikamsk great deposits of calcium have been discovered. This calcium will be transported by way of the Kama to the south to govfarms and colfarms.

All of this we shall accomplish by imprisoning spring waters.

The time has passed when men only contemplated nature, when they looked at her from afar as spectators. For us, the

waters of spring are not merely something about which to write verses. They fill the banks of rivers; they give us energy to turn the wheels of industry.

A great new power has appeared in nature – the power of human labour. Not only the blind forces of nature, but also the conscious, organized, planned labour of man now fashions rivers and lakes, plants forests, and transforms deserts, moderates and accelerates the flow of waters, creates new substances and new species of plants and animals.

XII. NEW PEOPLE

1. A Fragment from a Book to be Written Fifty Years Hence

They lived in crowded dwellings with little windows, with dark, dirty corridors, with low ceilings. Of every five or six persons, one had to sweep and scrub the floors, cook the food, go marketing, wash clothes, nurse the children. With rare exceptions this work was done by women, the so-called "housekeepers." At that time there were already on the market such inventions as mechanical potato-peelers, meat-choppers, dish-washers, clothes-cleaners, and other devices. But in spite of this, millions of women continued to work with their hands. Small wonder that even by toiling fifteen or sixteen hours a day they were unable to finish their work. Rooms were cleaned thoroughly only twice a year, on the eve of great holidays. Children were always unkempt and ragged. Food was prepared carelessly, was tasteless and deficient in nourishment. Not one housekeeper knew the number of calories contained in two pounds of cabbage or a quart of milk. The cooking of the food was done in a "kitchen," that is, a small crowded room.

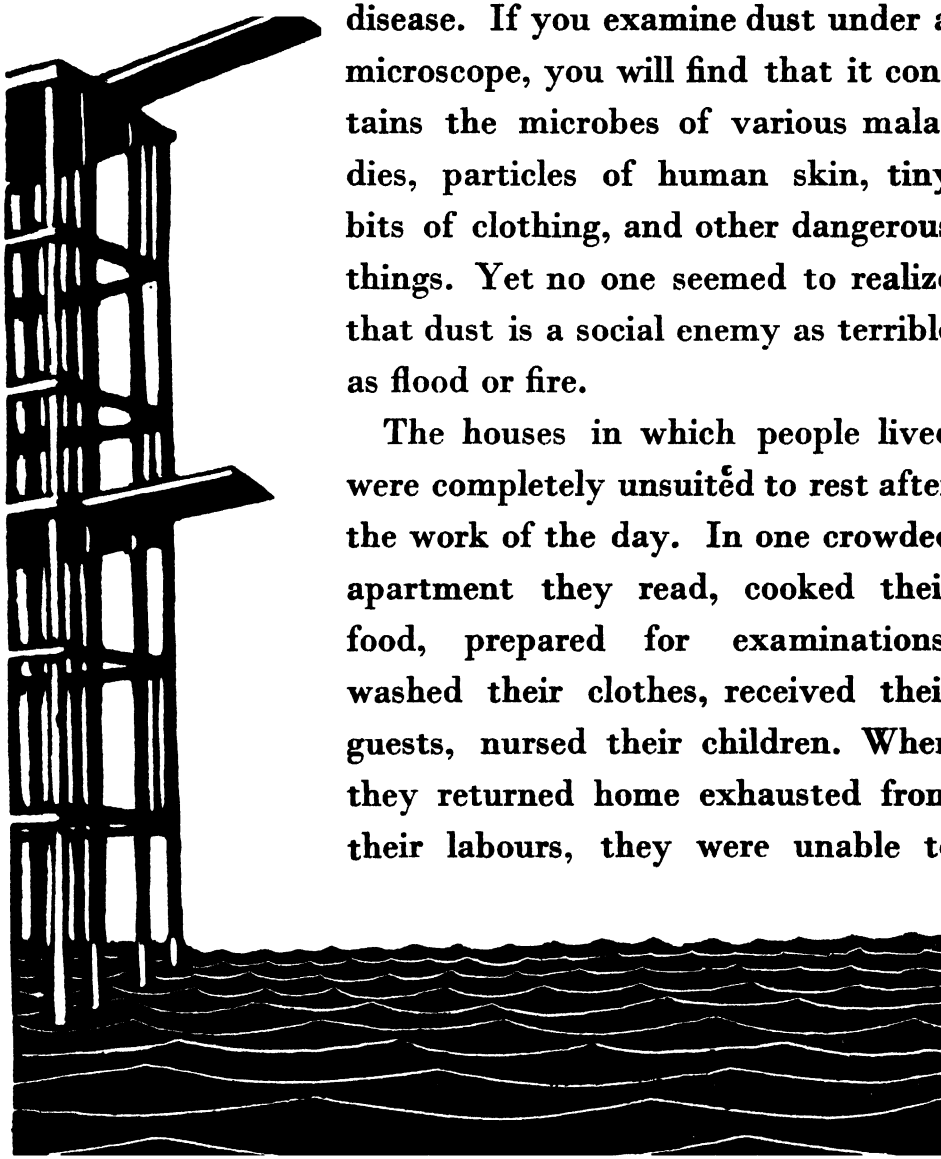
THIS MIGHT BE THE NIGHTMARE OF A HOUSE-KEEPER AFTER A DAY'S WORK

Steam kettles were altogether lacking and food was cooked over an open fire. An unheard-of amount of wood was consumed in the process – in those days they still used wood for fuel. The food often burned, and a suffocating smoke spread through the rest of the house. Here in the kitchen also was a garbage pail to hold the wastes of production: potato peelings, herring tails, bones, and so on. During the day this refuse poisoned the air: not until evening was it emptied into a kind of half-closed garbage hole in the yard. No one thought of turning the wastes of the kitchen into fertilizers or to some other useful purpose.

As a rule every room in the house was heated separately. Very few homes were equipped with central heating systems. Even as late as 1930 there were open fireplaces and stoves in nearly every house in Great Britain. This wasted enormous quantities of fuel and was dirty.

The furniture in the rooms was heavy, clumsy, and uncomfortable. Light metal furniture was then almost unknown. The most popular chairs and sofas were covered with cloth and filled with hair or sawdust. In order to raise a great cloud of dust all you had to do was to tap lightly the seat of one of these articles of furniture. On the floor they laid pieces of thick carpet. On the walls they hung little shelves and pictures. The windows, besides being small, were screened with curtains which shut out much of the

light. All of these things were done even though the fact had already been established that dust is a source of disease. If you examine dust under a microscope, you will find that it contains the microbes of various maladies, particles of human skin, tiny bits of clothing, and other dangerous things. Yet no one seemed to realize that dust is a social enemy as terrible as flood or fire.



The houses in which people lived were completely unsuited to rest after the work of the day. In one crowded apartment they read, cooked their food, prepared for examinations, washed their clothes, received their guests, nursed their children. When they returned home exhausted from their labours, they were unable to

find the rest they needed to renew their energy and vigour for the following day.

In the majority of families, children had no care during the entire day because their mothers were at work outside the home or busy with household duties. Every large building boasted a yard which was somewhat like a well surrounded by four stone walls. In this yard there was usually a hole to receive the refuse from the kitchen. And this dark place, without sunlight, without trees, and without grass, was the children's playground.

Still worse lived the people in the villages. One political leader wrote as follows at the beginning of the twentieth century:

"Most of the peasant huts are eighteen by twenty-one feet. In such a hut are housed on the average about seven people, but there are huts – little cages – no larger than twelve feet square. The stove occupies about one-fifth of the total air space. It plays here a tremendous role in the life and the economy of the family. Not only do the peasants warm themselves by it, but they also sleep on it and use it for drying clothes, shoes, grain, hemp. Not only do they bake and cook with the stove, but they also depend upon it for steam baths. And under the stove chickens, calves, and sheep are often protected from the frosts of winter. Not infrequently the cow is also brought into the hut at the

time of calving. Practically the only furniture is a table which serves both cooking and dining purposes. On this table too all kinds of housework are done, harness repaired, clothes are made and mended. A common saying among the peasants is: 'We are so poor that we haven't even anything with which to feed the cockroaches.' "

Thus lived millions of people. And the remarkable thing is not that they existed, but that they did not all die.

2. New Life and New People

All this will be written about us a few decades hence.

We live badly. We change nature, but as yet we have not changed our own selves. And this is the most essential thing. Why have we begun this tremendous task which will take not five, but fifteen, twenty, and perhaps more years? Why do we mine millions of tons of coal and ore? Why do we build millions of machines? Do we do these things merely in order to change nature?

No, we change nature in order that people may live better.

We need machines in order that we may work less and accomplish more. By the end of the Five Year Plan the working day in a factory will be reduced by 50 minutes. If we assume that the working year consists of 273 days (not counting rest days and holidays), the worker will

labour 227 hours a year less than he did at the beginning of the plan. And 227 hours is almost 33 seven-hour working days.

He will work less and yet accomplish more. During seven hours in the factory he will do what now requires eleven-and-a-half hours.

And if this is so, his wages will be raised by fifty per cent.

In comparison with conditions before the revolution, every worker will labour three hours less a day and yet will receive twice as much pay.

But this is not all. Work will be made easier. No longer will there be bent backs, strained muscles, swollen veins on the forehead. Loads will travel, not on people's backs, but over conveyers. The heavy crowbar and hoe will give place to the pneumatic hammer and compressed air.

Instead of dark, gloomy shops with dim, yellow lamps there will be light, clean halls with great windows and beautiful tile floors. Not the lungs of men, but powerful ventilators will suck in and swallow the dirt, dust, and shavings of the factories. Workers will be less fatigued after a day's labour. There will be fewer "occupational" diseases. Think of all the people who die now of these illnesses! Every metal-worker has lungs eaten up by metal dust. You can always tell a blacksmith by his pale face, a stoker by his red inflamed eyes.

IN SUCH HOUSES EVEN COCKROACHES REFUSE TO LIVE. THIS PICTURE WAS TAKEN LONG AGO, BEFORE THE REVOLUTION

After we build socialism, all will have equally healthy faces. Men will cease to regard work as a punishment, a heavy obligation. They will labour easily and cheerfully.

But if work will be a joy, rest will be a double joy.

Can one rest now in a crowded and noisy home amid the hissing of oil burners, the smoke of the kitchen, the drying of wet cloths, the filth of dim windows, dirty furniture, spittle-spattered floors and with unwashed dishes on the table!

After all, man is not just muscles with which to work. He is not a machine. He has a mind that wants to know, eyes that want to see, ears that want to hear, a voice that wants

WORKERS' HOUSES IN THE NEW CITY ARMENIKEND NEAR BAKU

to sing, feet that want to run, to jump, to dance, hands that want to row, to swim, to throw, to catch. And we must organize life so that not merely certain lucky ones, but all may be able to feel the joy of living.

After socialism is built there will no longer be dwarfs – people with exhausted, pale faces, people reared in basements without sunshine or air. Healthy, strong giants, red-cheeked and happy – such will be the new people.

But to accomplish this we must have new cities and new houses. Our whole life, even to the last kitchen pot, must be changed.

Down with the kitchen! We are going to destroy this little penitentiary! We shall free millions of women from housework. They too want to work like the rest of us. In a factory-kitchen one person can prepare from fifty to one hundred dinners a day. We shall make machines peel the potatoes, wash the dishes, cut the bread, stir the soup, make the ice-cream.

Down with the dark and small and crowded dwelling!

We shall build large houses – communes with light, spacious rooms. Let us understand once for all that it is impossible to work, rest, study, cook, and receive guests in the same place. There must be separate rooms for rest, for play, for reading, for dining, for receiving guests. And children must have rooms of their own. Adults frequently complain that children interrupt their sleep, their study, their conversation. But let not the grown-ups annoy the children and interfere with their noise and games.

Already we have such houses. The newspaper *Pravda* writes that in Moscow in Khavsky Street a "house Commune" has recently been built.

It is a very large building. On the first floor there is a light and spacious dining-room: on the second an auditorium with a balcony for lectures, entertainments, and moving pictures. Next to the auditorium are several rooms for meetings, for libraries, for noisy or quiet rest, rooms for

the receiving of guests. The third floor is a many-roomed gymnasium. On the flat roof of the building benches are placed and flower-beds arranged. In summer people will rest and take sun and shower-baths here. In winter the roof will be converted into a skating-rink, and merry skaters will cut figures on the ice high above the streets of Moscow.

For little children several rooms are reserved on the first floor. Here are play-rooms (make as much noise as you please!) and class-rooms and shops and verandas.

All rooms are light and cheerful.

Colours are selected so that they may delight and not tire or injure the eyes.

But we need not merely new houses: we need new socialistic cities.

The old city is a huge pile of gloomy and crowded houses, a cheerless world of stone walls and pavement. Only here and there may be seen little islands of green squares. But the further you go into the centre of the city – into the workers' quarters – the dirtier and darker become the streets. For those who can extricate themselves from this stone hell at least once a year, life is not too bad. But there are people who never leave the city.

I remember that once in our class we laughed at a boy who had never seen a sheep. This little boy was born and reared in Borovoy Street. There also he died. Not once during his

whole life was he fortunate enough to walk through a forest or a field.

Down with these abominable old cities! Like huge lichens they have grown and spread over the earth. We must make them over and also construct new socialistic cities. A socialistic city will be entirely different from the city that we know.

3. The City of the Future

How was the old city built?

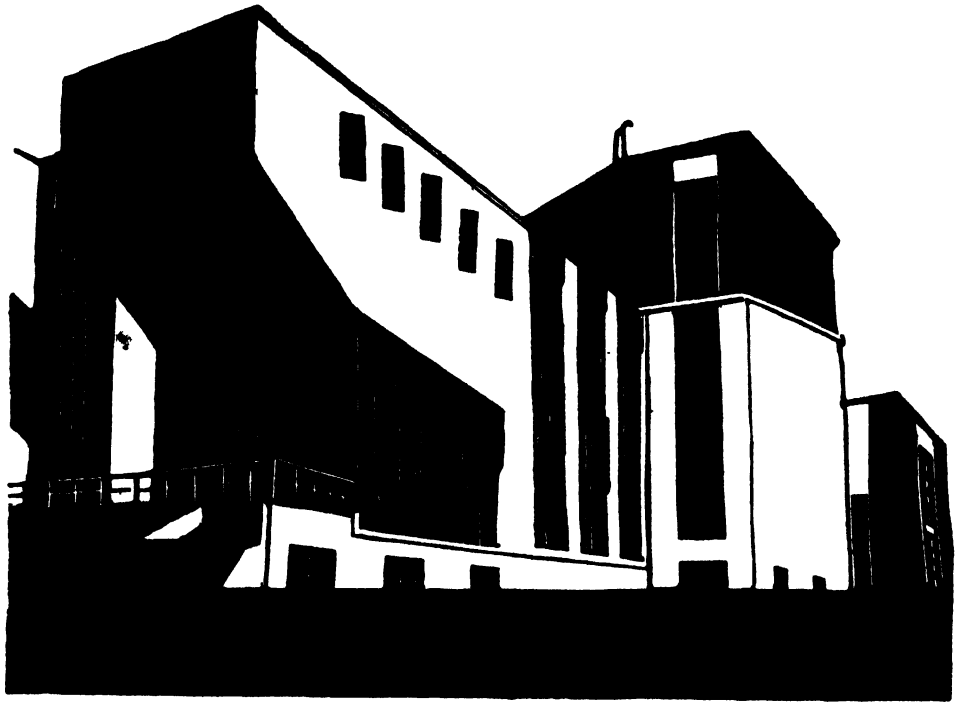
In the centre a fortress, a kremlin, an inner citadel.

Around this centre a ring of markets, shops, and stores grew up. And when they began to build factories, a third ring of the city appeared – the factory district. Among these shops, markets, and factories they erected dwellings – the better ones in the heart of the city and the poorer ones in the outskirts.

A new city will not be built thus. Its centre will be, not a fortress, or a market, but a factory or an electric power station.

About each large electric power station, about each large factory or union of factories, a city will spring up.

Not the grey wall of a fortress with stone teeth and look-out towers, but a green wall of parks will separate the heart of the city – the factory – from the residential sections.



A NEW CLUB FOR COMMUNE DWELLERS IN MOSCOW

This green wall will protect the city from the smoke and soot of factory chimneys.

And the blocks will be different.

From the central square, like the rays of the sun, avenues and boulevards will radiate in all directions. Buildings will not stand in a row like soldiers, all facing one way. Each dwelling will turn toward the sun in order to get as much of its light as possible. White house-communes, schools, libraries, hospitals, will be surrounded with flower-beds.

At every entrance you will be greeted by green giants – oaks, pines, lime trees.

Happy singing of birds and the calm, sustained, refreshing voice of trees, instead of the present clang and rumble and roar, will be heard in the streets of the city.

There will be none of that incessant bustle and scramble which now shatter the nerves of all of us city dwellers.

Institutions will be situated far from dwellings. People must live in quiet and peaceful places.

There will be less traffic in the streets and no such colossal cities as we now have. A city of one hundred thousand inhabitants will be considered too large.

Every future city will be a workers' village near a factory. And factories and unions of factories will not all be brought together in one centre as at present: they will be distributed throughout the entire country according to a rational plan. Our raw materials are found, not in one place either, but in a thousand places.

This is the way a city will be built. But how about the village?

There will be no village. Bread and meat and milk will be secured from factories in govfarms and colfarms. Around each of these agricultural factories other factories will be constructed – food, flour, conserve, meat, refrigeration. All of these will constitute a single union of factories,

but agricultural rather than industrial. And around each of these unions a city will rise – an agricultural city. This means that the difference between city and village, between peasant and workman, will disappear. Even the words *peasant* and *labourer* will pass away.

Only the word *worker* will remain.

This will happen after we construct socialism. But already during these five years we shall build about two hundred socialist cities, thousands of house-communes. Already the difference between city and village is being effaced.

Socialism is no longer a myth, a fantasy of the mind. We ourselves are building it.

But the task of building socialism is not easy.

We are surrounded on all sides by enemies.

Like the builders at Dnieprostroy we have raised protecting walls around us. But any minute the water may break through the walls, rush into the enclosure, overturn and destroy everything that we have done.

And that is why the work must go on so rapidly and with such concentration.

More quickly must be erected the stone dams of factories and mills. More quickly, because time does not wait.

If we try hard enough we can fulfil the Five Year Plan, not in five, but in four years, or even sooner. Already we have decided to achieve it in four years in the case of pig-

iron and steel, in three-and-a-half years, in the case of petrol and cement, in three years in the case of coal, oil, peat, tractors, and motor vehicles. We planned to increase the production of machines during the five years three-and-a-half times, but we shall increase it eight times. We planned to raise the output of pig-iron to ten million tons a year, but we shall raise it to fifteen millions. The production of coal will rise, not to seventy-five million tons, but to one hundred and twenty millions; the production of oil, not to twenty-six million tons, but to forty millions.

All the figures have grown, all the tasks have multiplied. Every day the papers spur on the laggards. In every enterprise shock brigades are at work. One factory sends a challenge to another: which will do the task faster, which will do it better?

Millions of workers are striving to carry out the Five Year Plan successfully; every one hopes that life will be better afterwards.

Yes, life will be better afterwards, if we will it.

4. Factories for Re-making of People

A great plan men have conceived, a great task they have set themselves. To change nature and to change themselves. Are we, such as we are, fit for the new way of life? We know

COLFARM WORKERS ARE LEARNING TO READ AND WRITE

little; we have few engineers, few physicians, few scientists; half of us above eight years of age in the village cannot even read. In America only six per cent. of the people are illiterate. We need factories not only to refine iron and steel. We also need factories to refine people: we need schools, universities, libraries, cottage reading-rooms; we need books and newspapers – many times more than we have now. We

must eradicate drunkenness; we must close drinkshops and replace bars with theatres and moving pictures, with clubs and rest homes.

We must root out uncouthness and ignorance, we must change ourselves, we must become worthy of a better life. And this better life will not come as a miracle: we ourselves must create it. But to create it we need knowledge: we need strong hands, yes, but we also need strong minds.

5. The Little Five Year Plan and the Big Five Year Plan

Do not imagine that the Five Year Plan is wholly the work of grown-ups.

Every child can be a builder of the Five Year Plan.

"The Lysvensky Factory Children's Brigade constructed a water and a wind mill and started a dynamo.

"On the Briansk road ten miles from Moscow in the village Peredelkino, the Khamovnichensky Region Children's Brigade electrified their camp. They dammed a small river, set up a water wheel, attached to it a small dynamo from a cinema apparatus, stretched wires to the camp, and henceforth illuminated their tents with electricity during the darkness of the summer nights.

"The youngsters of Ribinsk, while studying their

own region, found deposits of lime which is entirely suited for use as fertilizer. The Novosiberian Comsov-youths' and Children's Brigades discovered resources worth many millions of pounds sterling. They went on a scouting expedition and stumbled upon beds of coal and iron.

"On the outskirts of Moscow a children's city working independently built a macadam road approximately three hundred yards long and planted apple trees on either side.

"The children of the Zherdevsky Colfarm collected apple-cores and planted the seeds. They thus started a fruit orchard. Next year they will supply every household with valuable cuttings."

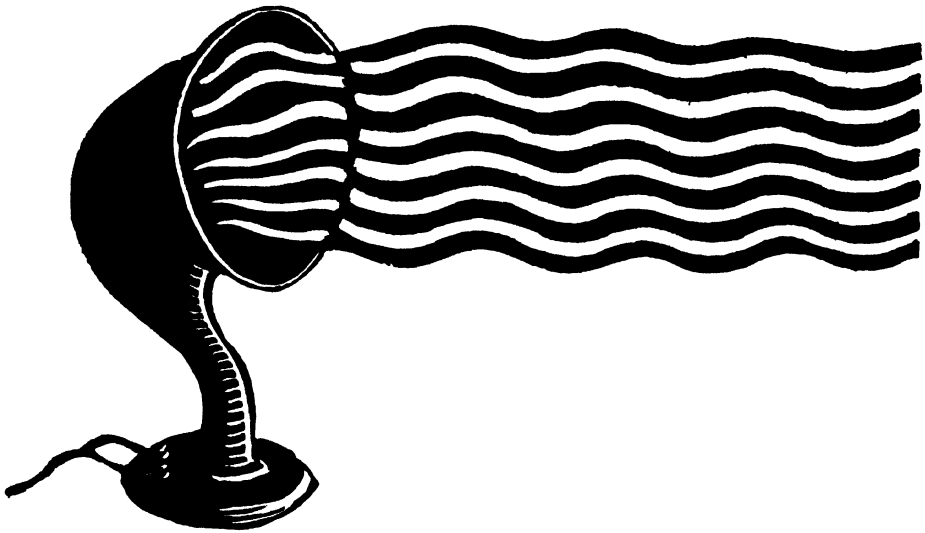
All these accounts I have taken from the report of the Children's Brigade Rally. There are dozens of such items in the report.

You thus see how children can help achieve the Five Year Plan. Fulfil your own little plan and then the big plan will be fulfilled before the assigned time. Whether it will be a task which requires a few days or a few weeks matters not: it will be your contribution.

Here it is – the Children's Five Year Plan:

(1) To discover beds of lime and phosphorus.

(2) To gather useful junk: rags, ropes, wool, bones, scraps



of metal, and so on. All of these things will come in handy in our factories. Every child should collect not less than forty pounds a year.

(3) To build wireless sets and loud-speakers. Within the next few years seventy-five thousand wireless sets should be installed in villages. Not one school should be without a loud-speaker.

(4) To learn to get full marks for sorting grain grown on your parents' farms, for seed.

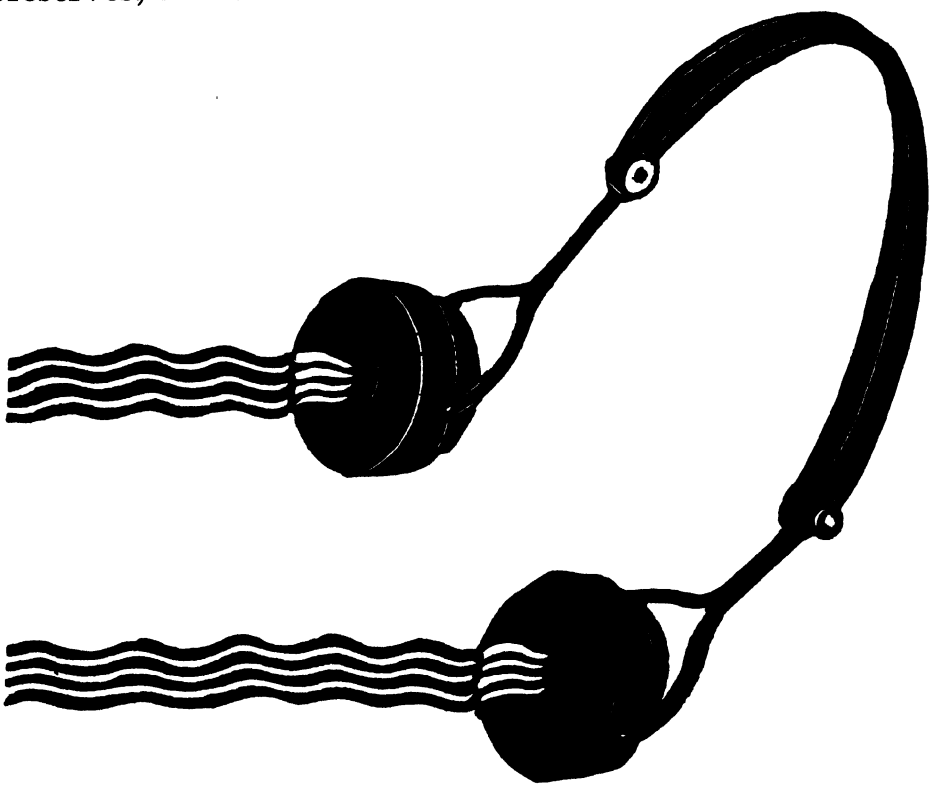
(5) To gather ashes for fertilizing fields. Each Children's Brigade should gather two tons of ashes a year.

(6) To destroy ten marmots a year in the regions infested by these animals; to clear one-fifth of an acre of land of parasites; to destroy all injurious insects on one

fruit tree and on ten vegetables; to catch or destroy five rats and ten mice.

(7) To build one starling house and two feeding houses a year; to raise the number of starling houses to a million and a half and of feeding houses to two millions. Birds are our allies: they will help us destroy parasites.

(8) To organize in five years, five thousand children's bird-preserving clubs, to found five thousand collective bird preserves, and to build five thousand chicken houses.



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(9) To add two good laying hens to the possessions of every peasant household.

(10) To plant ten trees each in five years; to create Children's Brigade forests of seventy-five million trees.

(11) To destroy bedbugs, cockroaches, and flies in five hundred thousand houses. Each troop should clean up ten houses.

(12) To teach the illiterate to read and write. Each troop should endeavour to wipe out illiteracy in its region.

These are only some of the chief tasks for children. If you wish to learn the details, read "The Report of the Children's Brigade Rally."

Grown-ups will build large electric stations; children can build small ones. Grown-ups will build large houses; children can build starling houses and bird-feeding houses.

And do not imagine that these are trifles.

If children fulfil their Five Year Plan, they will save from parasites grain worth £400,000.

If children add two good laying hens each to the possessions of each household, they will make a present to the State of five billion eggs, £20,000,000.

From pennies, millions are composed; weak hands, if they be many, can move mountains and plant forests of trees.

Herein lies the power of children.

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